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GEOGRAPHY IN RUSSIAN HISTORY

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THE history of Russia affords a striking example, not only of the influence of geography on history, but of the fact that man's place in the scale of civilization is in large measure determined by his environment. In speaking of the contrasts in the development of Russia as compared with England, a recent writer says:

> The fundamental difference between Russian and English history is the difference between the great plain and the island. English history tells of the upbuilding by an island people of the greatest maritime empire in the world. Russian history tells how a people . . . gradually, with toil, pain and effort secured possession of the greatest plain in the world and so created the broadest of land empires.

The empire of the plain! The very phrase suggests what Professor Kluchevsky calls the most characteristic feature of Russian history, namely, a spreading out or expansion over contiguous territory, a colonization.

It is not, however, only when comparison is made with England that geography appears so conspicuously as a factor in shaping the fundamental character of Russian development. Thus eastern Europe is organized into one single political unit, while western Europe, that is the smaller half of the continent, is divided into nineteen separate and independent states. The causes are manifest if we glance at the map. The surface of western Europe is broken and diversified, there are plains surrounded by mountains and uplands, there are transverse ranges making climatic divisions, and the sea penetrating deeply into the heart of the continent serves further to create physical or geographic units which invite the growth of separate states in response to boundaries set by mountain and sea. In eastern Europe, on the other hand, a great level plain spreads itself over an immense area. There are no divisions

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and no barriers and as a consequence no separate states over all of this great region.

The size of the Russian empire is therefore tremendous. European Russia is in itself larger than the other nineteen states of the continent taken together, and when we include Asiatic Russia, western Europe shrinks into insignificance. The Russian empire comprises one sixth of the total land area of the world; it is four times the size of the continent of Europe, forty-two times the size of France, nearly three times the size of the United States without Alaska, and seventy times the size of the British Isles. An English sailor knowing little about geography, and not yet caught by the propaganda of the English press in favor of things Russian once declared the "Rooshan" was everywhere. "I met him in the Baltic, then I sailed around the whole of Europe and found him on the Black Sea, and after six months around the Cape to India and China, I met him again on the Pacific." There are one hundred and seventy-five million Russians, and yet Russia is the most thinly populated of the great nations. "When you get to my country," said a young Russian nobleman from Bessarabia to me as we neared Libau on the steamer, "You will see how Russia is big, very big!".

Despite its immense extent, however, the land under the scepter of the Tsar constitutes a geographic unit. Even geologically it possesses a degree of uniformity found nowhere else over so large an area. From the Arctic to the Black Sea and from Poland to the Urals, and even farther Siberia, the strata are horizontal. The last of European land to emerge from the glacial drift, it has not been lifted, broken or forced out of place by the great upheavals which caused the diversified surface of western Europe.

Even as to its boundaries or frontiers, it is exceptionally clearly defined and the political state conforms on nearly all sides to the natural or physical. I say nearly, because towards Austria the Carpathians constitute a natural boundary which the Russian state has not yet reached, and which Petersburg confidently hopes to attain through the present war. Then too there are no geographic limits at two important points. Reference to the map shows that there is no physical boundary on the middle west where Russia merges into the German plain. Although nature forgot to form a natural frontier in this region, the ethnic factor entered in and the presence of the Teuton, for the time being at least, staked out a frontier against the Slav. But as usually happens when the ethnic frontier is unsupported by an adequate geographic boundary, confusion and friction arose. Even in times of peace the mothers of East Prussia are wont to silence their children with the ominous warning "Hush, the Rus is coming!" In Poland the absence of a natural boundary is dramatically reflected in political history, not only in the sad tragedy of the destruction of that kingdom in the eigh-

teenth and nineteenth centuries, but in the frequent struggles for the mastery of the borderland, so poignantly driven home, even to us at this distance, by the conflict now waging on the banks of the Vistula.

The other point where the natural frontiers are absent is in the southwest, towards the Danube. There the fact that the Carpathians do not reach to the Black Sea but double back on themselves, leaves an open and inviting road to the rich lands of the lower Danube, while the Black Sea itself offers an even more attractive outlet by way of the Bosphorus and Constantinople as the gateway to the Mediterranean and one of the world's great trade routes. And how many diplomatic intrigues, wars, conventions and treaties have had their origin in this simple geographic condition.

According to the latest investigations by Russian historians, the Slavic race was, about the second century after Christ, swept by the surging currents of racial migration into the region of the lower and middle Danube. But they were not allowed to remain, for it was they who received that terrible thrashing by Trajan's Romans. As a result of this, a large portion of them turned back, retraced their steps across the Carpathians into the Russian plain, and there on the banks of the lower Dnieper at Kiev slowly organized into a state. Indeed it is this little principality at Kiev that marks the beginning of the Russian nation. Its growth was stimulated by two great historic events. The first was the coming of the Scandinavians under Rurik and the subsequent assimilation, infusing into the Slav, especially the upper or commercial class, some of the military spirit of the north. The second was the adoption of Christianity about the year 1000. The conversion of the Eastern Slav was a step of momentous importance, for it brought a new force into his life. It also articulated, at least partially, his religion with that of western Europe. Partially, for as might be expected, the influence of geography told here, and the proximity of Kiev to Constantinople led the Russians to adopt the Eastern or Greek form of Christianity instead of the Western or Roman. Indeed the adoption at this psychological moment of the Byzantine religion and the Slavonic liturgy may well be regarded as the most fateful moment in Russian history. Later the marriage of Ivan III. with Sophia, the niece and heir of the last of the Constantines, gave to Russia not only the emblem of Byzantium, the double-headed eagle, but a claim to Constantinople itself.

The glories of the early civilization of Russia at Kiev, which even chroniclers of the west say outshone that of Alfred or of Charles the Great, can not delay us here. About the middle of the twelfth century, it was, however, violently interrupted by a great invasion by the Tartar hordes from Asia. The "Man of Rus," the Russian, was conquered and his civilization submerged. Kiev was abandoned in 1240 and those who

could retreated, "trekked," northward into the region of the Volga and the Oká. There, in central Russia, this enforced colonization or "trekking" resulted in the development of the Great Russian stock, which to-day occupies the heart of Russia and constitutes two thirds of the Russian race. Sheltered in the almost impassable forests of central Russia, the Russian retained his nationality, and slowly recovering his strength, not only threw off the Tartar yoke but also freed his kinsmen on the Dnieper. In the subsequent centuries he fought his way to the sea.

The story of the rise of Moscow as the center from which the new Russia slowly expanded till it occupied the great plain of eastern Europe and northern Asia is well known. Midway between the Russian on the Volga and the Russian on the Dnieper rose Moscow, at the meeting place of the three great roads of the region. Its beginning must have been very humble for a rhymning tale of a little later period marvels much at its rise,

> **What man ever thought or divined that Moscow could be accounted an Empire? Once by the river Moskva there stood only the goodly hamlets of the boyar, of the worthy Stephen Kutchak the son of Ivan.**

Under Ivan the Terrible in the sixteenth century, the mighty Volga, "Mother Volga," was conquered and its cities Kazan and Astrakhan brought under Muscovite rule. Then towards the end of the sixteenth century, the conquest of the land to the east was begun. On New Year's Day of 1581, Yermak, the trapper and giant pirate of the Volga, having been entrusted with a commission by the Tsar, set out to subdue the tribes of Sibir, whence the name Siberia, and the lands of the rich fur trade. A century later the Pacific was reached and northern Asia was added to the Tsar's dominions during the very period that marks the great colonial expansion of France and England.

With the accession of Peter the Great, an era of conquest began which gave the Russian his opportunity to expand over the plain westward. Geographically, as we have seen, it formed a part of the Muscovite territory but hostile races were in possession. During the reign of Peter the Great and later Catherine II., we see the conflict of the rival races for control of all the western provinces of present-day Russia. The victory was with the stronger ethnic group. Peter the Great got the Baltic provinces, pushing the frontier to its natural line, the sea, and in the founding of Petersburg placed "a window," as he put it, for Russia to look out upon Europe; a century later Catherine got a large portion of Poland, adding "the doormat" also. This completed the Russian advance into Europe in this direction save for the acquisition of Finland in 1809 and a further portion of Polish land including the city of Warsaw in 1815.

But the difficulties in the way of expansion to the geographic fron-

tiers encountered in Europe were either not present at all in Asia or else were too weak to offer substantial resistance. Hence Russia has in the last 100 years pushed out to the confines of India and China and added millions of square miles to her territory beyond the Caspian and in southern Siberia. In one place, she has even gone beyond what would appear as the normal physical boundary: in the conquest of the trans-Caucasus she has begun a march that points to the Persian Gulf as her ultimate goal.

Turning now to the more intimate relation of the great Russian plain to the people who have made it their own, a number of striking facts appear. In the first place, it has produced and preserved for the whole vast central area a common physical type, a common religion and a common language. The 125 million Russians occupying this central territory of the Russian plain, as has been often pointed out, show a truly astounding uniformity of head formation when one takes into consideration the size of the territory and the number of people involved. The variation in cephalic index, according to ethnologists, is only about 5 points around 82. That is to say, the Russian not only belongs to the round-headed type, but the ratio between the length and the width of head among the 125 millions varies astonishingly little when compared with the variation in the cephalic index in races whose habits and environment show greater variety. Among the Italians, for example, it is as high as 14 instead of 5 as in Russia, and in France it is 10. Yet both the territory and the number of people involved in each case is very much smaller. A further point of some interest is the fact that Slavic skulls thirteen centuries old, found in this region, exhibit the same peculiarity. Evidently the absorption of the Varangians, and later, of the Turco-Finnish tribes of the region, has in no way affected the head formation. The power of the great plain is dominant and the uniformity and monotony of the land reflects itself in an unparalleled extension over a vast area of a uniform type of head formation.

It would be a mistake, however, to leave the impression that, since a common head formation prevails among the Russians, they are alike in other respects. Quite apart from the many alien races on the frontier, there are three main groups among the Russians themselves, differing from one another not only in dialects, habits and disposition, but physically as well.

First there are the Great Russians numbering over 82,000,000 and much the largest of the three groups. They occupy the heart of Russia with Moscow as the center. Second is the Little Russian, about 37,000,000 strong. He holds the territory south and southwest, including the Don Cossacks, and his center is at the old and first capital of the Russians, on the Dnieper at Kiev. Third is the White Russian, about 5,000,000 in number, in lands east of Poland and northward around Lithua-

nia. The land of the White Russian is heavily wooded and in parts marshy, the soil like that of the Baltic provinces being poor and unproductive. The territory of the Little Russian, on the other hand, is flat and open, comprising the rich black earth belt and the vast grazing steppes of the south. The home of the Great Russian extends from White Russia eastward to the Volga and from Little Russia northward towards the Arctic.

The distinction between these groups is not fanciful but very real. The language spoken by the three groups, though basically the same, differs so much that they can not understand each other. One may be quite conversant with Muscovite and yet be unable to understand the Russian of the Ukraine. Indeed on the border territory between Great and Little Russia villages are found where the two peoples have lived side by side for generations without mixing and without understanding each other's speech. The two groups also differ markedly in appearance. The Great Russian is blonde with chestnut or auburn hair, light complexion and beer colored eyes. In disposition he is phlegmatic, stolid and stubborn. The Little Russian, on the other hand, though possessing the head type of the eastern Slav, as I have already indicated, is dark, even swarthy, with brown eyes and dark brown hair. A further difference appears in his stature, for the Little Russian, despite his name, is big, considerably taller on the average than his brother the Great Russian. The reason for this is not easy to find, unless the greater stature of the Little Russian is but another reflection of the influence of environment. The Little Russian occupies the best land of Russia, the fertile soil of the black earth belt, and the consequent better nourishment extending over a long period of time together with some admixture of old Polish stock is doubtless responsible for his larger stature.

But it is not merely physically that the Little Russian differs from the Great Russian. He differs from him quite as much in disposition and habits of life. He is more mellow and open hearted; the sun of the southland has made him kind, hospitable and emotional. He is musical, highly imaginative and poetical, fond of pleasure, games and dancing. To him Russia owes most of her music, her poetry and her folk song. "What ecstasy, what joy has a summer day in Little Russia," cries Gogol, in the bleak and uncongenial Petersburg, as he writes his "Evenings on a Farm in the Ukraine." Indeed this gifted son of Little Russia, whose sketches reflect so many of the characteristics of his native land, denied to the Great Russian with his roughness, surliness and phlegmatic character, any share or claim in the Slavonic race. With the White Russian we can not linger; he is regarded by some as nearest the original type of the eastern Slav. His name is probably a result of the color of his clothes—a light-colored homespun devoid

as well of the somber hues of the Great Russian's attire, as of the brightness and variegated colors of the Little Russian.

But despite these differences, the great plain dominates, and environment added to common history and a common religion, has produced a people of greater homogeneity than is known anywhere else on so large a scale.

Among the races of the frontier, the differences are more striking, not only between group and group but between each group and the Russian proper. They occupy the territory on the outer border; Poland, the Baltic provinces, Finland, the foothills of the Urals, the lower Volga, and the region of the Caucasus, and furnish almost every variety of head formation, stature, color scheme and what goes without saying, a veritable Babel of languages or dialects. The Russian Year Book for 1912 notes 101 languages or dialects, and there is excellent authority for the statement that at Tiflis 68 of these are in actual use.

First among the non-Russian peoples of the fringe are the Poles. There are between seven and eight million Poles under Russian rule, and at Warsaw one of the most tragic racial struggles of history has been in progress for well-nigh a century and a half. The Poles are Slavs but belong to the western branch of the race and are ardently devoted to the Roman Catholic instead of the Greek Catholic Church. Generally speaking the ethnic type more nearly resembles the Little Russian, both in appearance and character. But the effect of prolonged oppression involving the elimination of a large proportion of the best manhood is having its effects. This fact impresses itself more emphatically on the casual visitor because of the presence in Poland of millions of unfortunate Jews, forced into the country by the policy of Russian autocracy and necessarily living under conditions of the most cruel and grinding poverty.

To the north of the Poles and occupying the Baltic provinces, a region of birch and pine with a poor soil, are two peoples, the Letts and the Germans. The Letts with their chief center at Vilna constitute the lower class. They are at the same time the oldest remnant of the Aryan stock. There are between three and four millions of them; all belong to the peasant class and are a raw-boned race, simple in language, taste and habits. They were the last of the Aryan peoples to accept Christianity and their language is of interest because it is the most ancient form of Aryan extant. As might be expected it has scarcely any words to express abstract ideas, its vocabulary being confined to words for concrete objects. The upper class in the Baltic provinces is German. There are not a great many of them, but they are the great landed proprietors, business and commercial men. The chief cities are Riga and Libau. Riga in particular boasts of a history as-

sociated with the glories of the Hanseatic League, and to this day it impresses one as distinctly German in appearance.

Further to the north still, along the shores of the Gulf of Finland are the Finns, subjects of Sweden for many years, but conquered by Russia in 1809. Their culture is distinctly Teutonic and on coming from Russia to Finland one is at once struck by the absence of the Russian or Byzantine architecture in the churches; similarly the ubiquitous uniform of Petersburg is also absent. Altogether it is a world non-Russian, despite the fact that it has formed a part of the Russian empire for 105 years. The Finns are a non-European stock, Mongolian in origin, and physically differ considerably from the Russians. They are taller and belong to the long-headed type and the eyes are almost uniformly blue. They have had a constant struggle with a poor soil, an adverse climate and an overpowerful neighbor. Yet in Finland all can read, and very few are to be found who can not write also. One can not but be impressed with the industry and pluck of this valiant little people, and feel in sympathy with the Finnish economists who see in the geographic location and the magnificent water power of their country the basis for a great development in the future.

The Finns appear further as the principal people over the entire area of northern Russia, excepting the stunted and wandering Lapps with their reindeer, and the Samoyads—a heathen fisher folk of the northeast. Indeed this region was theirs till the Great Russian conquered it. Petersburg itself is set down in the midst of a Finnish country; a land of marsh and forest occupied by Finnish peasants, Teutonic in culture. Indeed from the ethnic standpoint the old name of the Russian capital is more in accord with historic and even actual conditions than its present one of Petrograd, which is of course the Russian instead of German for the city of Peter. The conquest of northern Russia by the Muscovites did not bring with it any war of annihilation or wholesale migration. Slav and Finn have existed side by side for generations, the latter being subjected to a gradual process of absorption by the Great Russian. The Finns in their little villages hold out stubbornly against it, women being particularly tenacious in retaining the old customs.

MacKenzie Wallace says,

> On the other hand, like women in general when they do begin to change, they change more rapidly. The men adopt the Russian costume gradually; women adopt it at once. As soon as a single woman gets a gaudy dress every other woman in the village feels envious and impatient till she has one likewise.

He tells of having tried in vain to buy a female tribal costume in several villages and finally going on to another expecting the same difficulty. Accordingly he had his inn-keeper make known his quest and the very liberal terms he was ready to offer. This time the result was startingly different. To give his own words:

In a few minutes . . . the house in which I was sitting was besieged by a great crowd of women holding in their hands articles of Finnish wearing apparel. In order to make a selection I went out into the crowd, but the desire to find a purchaser was so general and so ardent that I was regularly mobbed. The women shouting "Kupi, Kupi"—("Buy, Buy!")

The fact that toward the east the Russian has pushed across Asia to the Pacific does not mean that he has absorbed and Russianized what lies between. Indeed from Nijni-Novgorod where the Volga turns southward, that river, to the elbow at Tsaritsin, constitutes, in a sense, an ethnic boundary. Here non-slavic races—fag-ends of peoples—are found, preserving not only their own speech and habits but costumes as well. As a result a voyage on the Volga affords unique and fascinating points of interest, quite apart from its scenic and geographic features. A bewildering confusion of racial types appear. Asia and Europe seem to meet and intermingle, but not to coalesce. The focal point is at Kazan where the intermingling of strains of blood, of religions, of customs and of languages, is at its maximum. It is Russia's "melting pot." But thus far the heat has not been sufficient to effect a coalescence of the many racial ingredients it contains.

Turning from the discussion of the ethnic elements of European Russia to the conditions of life prevalent among them, geographic influences and environment appear in an equally striking manner as dominating factors; and nowhere more than in the ignorance and poverty so general among the great mass of the Russians. We are told that the mothers of Vladimir's day bewailed as dead the little ones taken from them to be taught the alphabet. To-day over seventy-five per cent. of the population is illiterate. Nor is this at all surprising. Only a hundred years ago, Russians were sold in the open market at Moscow. "To be sold: three coachmen, well-trained and handsome:—two girls, the one eighteen, and the other fifteen years of age, both of them good looking," etc., is one of many advertisements of the kind in the Moscow *Gazette* early in the nineteenth century. Serfs and cattle were intentionally put in the same category, as appears in such announcements as "In this house one can buy a coachman and a Dutch cow."

Not until 1861, the year made memorable in the United States by the beginning of the great war that liberated the negro, was the barter in Russian souls stopped by the emancipation edict of Alexander II. This barter appeared not only in the actual exchange of Russian subjects between one landlord and the other, but also in the unpardonable control exercised by the proprietor over the moral welfare of his serfs. The story told by Prince Kropotkin is familiar to many:

One landowner remarked to another, "Why is it that the number of souls on your estate increase so slowly? You probably do not look after their marriages." Thereupon the other went home and ordered a list of all the inhabitants of his village to be brought to him. He picked out from it the names of

the boys who had attained the age of eighteen and the girls just past sixteen,—those are the legal ages for marriage in Russia. Then he wrote, "John to marry Anna, Paul to marry Parashka," and so on with five couples, "The five weddings" he added, "must take place in ten days, next Sunday but one."

Many will remember Pushkin's exclamation as he listened with growing seriousness to Gogol's reading of "Dead Souls," "God! what a sad country is Russia!" or his comment later, "Gogol invented nothing, he tells the simple truth, the terrible truth."

First among the geographic influences underlying such conditions has undoubtedly been the remoteness of Russia from the main currents of European civilization on the one hand and her close proximity to, and contact with Asia on the other. When the Russian state revived in the fifteenth century around Moscow, it was not only isolated, but overshadowed and stifled by Asia. Evidences of this may be seen in many ways; one still hears the saying, "Scratch a Russian and find a Tartar." The art and architecture of Russia show unmistakable proofs of the necessity the nation was under so many years of bearing the brunt of the Asiatic onslaught. The contact with western civilization, on the other hand, was for a long period remote and attenuated, and the influence of the west upon the Russian masses imperceptible.

Another great difficulty arose from the fact that Russia did not lie on the way to any other part of the world. She has not been on any of the great trade routes or channels of human intercourse. To better understand the significance of this simple geographic fact, we have only to consider its influence in other parts of the world, as for example in the case of the prosperity and progress of the towns along the medieval trade routes, or the conspicuous decline of Renaissance Italy after the discovery of the western hemisphere. Following upon the voyages of Columbus, Vasco da Gama and Magellan, the trade routes left the Mediterranean for the Atlantic and coincident with this came the decay of the Florence of the Medici and the Rome of Julius II. On the other hand, the increased importance of Italy, and for that matter the Balkans, since the opening of the Suez Canal, reflects the return in part at least of the Mediterranean to its former place.

As if to emphasize the geographic isolation still further, infant Russia, following the suggestion of geographic propinquity, went to Byzantium for its religion. This fact was fraught with tremendous consequence, for to her geographic isolation Russia thus added religious isolation. She divorced herself from the religion, thought and culture created in western Europe by the medieval church. She did not share in the civilization in which the church and later the protestant revolt served as basic factors. Political and social institutions developed in ecclesiastical moulds. The very physiognomy of the cities was determined by it, so that even with the development of modern industrialism,

Moscow, Kiev, Petersburg and other places still have the appearance of ecclesiastical cities.

But there is another important factor underlying the slow development of Russia. It is the tremendous size of the Russian plain when considered in connection with the sparseness of the population. The average density of population for the Russian Empire is about 8 persons per square verst. In comparison with western Europe it is 20 times less than in England, 15 times less than in Germany and 10 times less than in France. This adds local isolation to national isolation for even to-day only about 14 per cent. of the population live in towns or near enough to be seriously influenced by the civilizing agencies of modern city life. At least four fifths of Russia is untouched by those powerful engines for progress in the western world, the public press and education. What this means especially during the long Russian winter with its enforced change of employment and relaxation of effort is manifest. There is sound geographic basis for the joy so constantly found in Russian literature at the return of spring after the prolonged winter:

> Spring, beautiful Spring! Come O Spring with joy!
> With great goodness, With tall flax,
> With deep roots, With abundant corn.

These lines have an element of strength that is born of the soil. Indeed they recall the fact that the immense size of the Russian plain reveals its influence in quite another and subtler way; in a certain largeness of character and outlook that can not be judged by the standard test of illiteracy. One feels it in one's associations, not only with the educated but with the people at large. Nor need one go to Russia for this; no one can read the Russian novel and not be impressed by a quality that is the very essence of the country's immensity. Gogol's Homeric romance of Russian history, "Taras Bulba," is crammed with it. It is a story of the old Cossacks in all their barbarous love of fighting, eating and drinking, their giant physical strength and vitality, their intense patriotism, and as W. L. Phelps puts it,

> their blazing devotion to their religious faith. . . . These Cossacks are veritable children of the steppes, and their vast passions, their Homeric laughter, their absolute recklessness in battle, are simply an expression of the boundless range of the mighty landscape.

Turgeniev's "Sketches of a Huntsman" though in a setting nearer Moscow and therefore totally different, has it just as does "War and Peace" by the greatest of all Russians, Leo Tolstoi. There is plenty of local color, of boundless steppes and forest, broad rivers, illimitable snow and long winter nights, but it all has an atmosphere of vastness that is wide as the world in its reach. The characters are cast in a large mould and the problems, though national in setting, are worldwide in their appeal. There is in Tolstoi a quality that is bred of the vicissi-

tudes of life on the Russian plain, of its contact with nature, its aloofness from artificiality, and its call upon the people for suffering and passive resistance.

Though again and again led by autocracy into wars of aggression, the Russians have shown an inaptitude for positive aggressive strategy. They have lacked the *punch*. Apparently invincible, as Napoleon, Frederick the Great and Charles XII. discovered, when resisting attack, they have so far failed in the offensive. Whether this is due to inferior military organization or to a national characteristic induced by environment, and described by Turgeniev, as a weakness of the will among individuals, is hard to determine. Both factors doubtless play their part. It took over an hour to add an extra coach to the night express on which I was traveling from Moscow to Nijni last July, and then a score of people were without accommodation and had to wait till the following day. And that was at Moscow, the principal railroad center of the country.

Another important fact in Russian development has been the predominance of agriculture over every other occupation. There has not been sufficient seaboard for a great commerce, and as yet, industrial development though fraught with great promise, is for the same reason in its beginnings. Of the 175,000,000 Russians, 125,000,000 are engaged in agriculture. A population of peasants! Indeed one is tempted to say an empire of peasants. The soil of the country as well as the climate varies so greatly that almost anything can be raised in Russia from the furs of the government of Archangel to the teas of the Crimea and the cotton of the Trans-Caucasus. In Russia's report for the Glasgow Exposition some years ago occurs the sentence:

> We possess a whole assortment of climates, ranging from that of the Polar regions, which is suitable to fur farming, to the sub-tropical in which may be cultivated for commercial purposes such plants as mandarines, tea and bamboo.

Across the northern portion of the country tundra prevails, but it is not for that reason worthless, for it contains some of the most valuable peat bogs in Europe, second only to those of the central provinces. South of the tundra lies a broad forest belt of pine and birch, with clearings on which flax, rye and oats are grown. Further south still is oak, beech and lime with large clearings for wheat and hemp. Next to this forest zone with its untold wealth in timber is the wide strip of rich vegetable soil which has given to the region the name of the Black Earth Belt. It stretches from the Carpathians to the Urals and even beyond into Asia. The area is covered with a rich deposit of black soil, varying in depth from 12 inches to 12 feet, which rivals the black loam of the Mississippi in its natural fertility, despite the fact that it has produced its crops since the days of Pericles. It awaits only the introduction of more intensive farming and up-to-date machinery to increase its productivity still more.

To the south of the Black Earth Belt lie rich grazing lands affording pasturage for millions of sheep, horses and cattle. In Bessarabia, on the shores of the Black Sea and the Crimea, are vineyards and fruit farms of great beauty and value. But even this by no means exhausts the unparalleled resources of even European Russia. The great variety of minerals in the Urals, the vast deposits of iron and coal in Poland, the coal and graphite of the Donetz Valley, I can only mention in passing. In the region between the Don and the Caspian Sea is the great saline desert, with its inexhaustible supply of salt and fertilizer. According to recent experiments, the soil can be easily adapted to the growth of the sugar beet. Further to the south are the rich oil beds. The output of petroleum in 1912 for the Baku region alone was 420,000,000 poods from over 4,000 wells, and the importance of this in the economic development of the country is inestimable. All Volga steamers now use mazout or crude oil as fuel.

These economic and geographic areas of Russia are in no case separated by physical barriers as is our Pacific slope from the states east of the Rocky Mountains, or even the Atlantic seaboard from the territory beyond the Alleghenies. Russia is without high relief; the watersheds are almost imperceptible elevations. Indeed European Russia is so flat that the Baltic-Black Sea Canal is to be made available for large ocean going vessels by the construction of only two locks. Naturally therefore the rivers and waterways of Russia have been of unusual importance, especially before the days of the railroad, in binding the different economic areas together, affording magnificent arteries for the movement of internal trade both in winter and summer. The rivers are large and sluggish, owing to their great length and slight fall. The Volga is the longest river in Europe. It is 2,300 miles in length, that is, three times as long as the Rhine, yet its total fall is only a little over 800 feet. The peat bogs in the Valdai Hills where it takes its rise are only 750 feet above sea level, while Astrakhan at the mouth is 65 feet below the level of the sea. The Russian fondly speaks and sings of it as "Matushka Volga" or "Little Mother Volga" in gratitude no doubt for the bounteous supply of fish, caviar and game, as well as comforts and pleasures afforded by this historic stream which plays so important a part in the economic life of the nation. The products of Asia and of Europe are carried on its waters; the 2,000 odd river steamers are always busy, and the huge rafts consisting often of thousands of logs, being floated or pulled down the stream, represent a small portion of the riches of Russia's inexhaustible forest lands.

Equally conspicuous at almost every part of the river are the scenes connected with the fishing industry, ranging from the small boy and the old man with the primitive rod and bait at the landing place, to the groups of queer boats with long nets which dot the bosom of the stream

from Tver to Astrakhan. Scientific laboratories maintained by the government for the study of the zoological and biological life of the river have been established at the principal fishing centers. Even in winter fishing is kept up. The fish bury their heads in the mud, their bodies rising upwards in the water. Holes are cut in the ice and the fish are speared, a catch averaging from 6 to 12 fish per spear. The caviar, of which there is the red and black variety, also comes chiefly from this region. The roe is separated from the tissue, beaten through a sieve, and salted for export or home consumption.

In its lower course the Volga enters the great depression once covered by the waters of the Caspian sea. It flows sluggishly past Tsaritsin through the great saline basin and finally loses itself in the Caspian at Astrakhan. This great inland sea, despite the fact that it is only a relic of its former self, is still the largest inland sea in the world. Notwithstanding the fact that it has no outlet, and receives the inflow of the Volga and the Ural, it is constantly declining in level. It is already over 90 feet below the level of the Black Sea. Nor is this all. Sudden and irregular fluctuations in the level have occurred so frequently in recent years that geographers have the theory that there are volcanic disturbances in the sea bed itself.

But despite the wealth of the Volga, the Baku and other regions, the Black Earth Belt is still much the most important. Upon the success or failure of its crops depends in a large measure the prosperity of the nation. Unfortunately the methods of agriculture, in most cases, are still very primitive, but in this as in other matters of Russian economic history rapid progress is being made and generalizations are dangerous. A visit to the fields of the sickle agriculture shows the small narrow strips of medieval times separated not by fences, wood is too scarce in the steppe region for that, but by a furrow or two left clear. A great many of these side by side give the impression of large, very large, fields of wheat, but the grain on each strip, small though it be, has a different owner. Land tenure in many parts of Russia since the emancipation of the serf by Alexander II. has been communal. The title to all rural land belonging to the peasantry was vested in the village community. Hence the Russian peasant was bound to his village which he could not leave save with the consent of the elders; he could not get his land in his own right and farm it as he would; he could not even get his land together in one piece. Instead it was scattered about in different parts of the communal land making him waste much time going from one strip to another. The village community was the absolute master and in its assembly of elders it allotted the strips of land each member was to have as his for cultivation. The result was inevitable. Not only did indifferent farming follow, but with the increase in the population the land had to be constantly re-divided, the strips becoming always

smaller, for the *mir,* as the village community is called, had no means of expanding and taking in new lands. The picture of the Russian peasantry drawn by Tolstoi, Tchekov and others reveals a pathetic state of suffering, misery and discouragement in the wake of what was planned to be a great economic and social reform. Stagnation in the economic life of the people was thus added to political and intellectual stagnation.

Even to-day millions of the Russian peasants are not only too poor to employ any but the simplest instruments of agriculture, but the smallness of their acres make the machinery we are accustomed to out of the question. On the other hand, there are large estates with the finest modern machinery, while the peasant proprietor is gradually overcoming the difficulty by cooperative buying. Six million households were associated with cooperative associations in 1911, and 310 out of the 370 Zemstvos were last year engaged in the sale of agricultural machinery. Long years of experience in the semi-communal dealings of the "mir" have trained the Russian peasants in the qualities necessary for cooperative enterprise.

In the meantime the Zemstvos and the government technical schools are doing all in their power to develop more scientific agriculture and the prospects are good for a thorough reform in agricultural methods in Russia in the near future. Fortunately, a reform inaugurated by the late premier Stolypin in 1905 and now being slowly forced upon a reluctant and conservative peasantry is working a deep and far reaching agrarian revolution. By the application of the Stolypin measure, the Russian peasant can now withdraw from the village community and obtain the consolidation of his holdings, to which he gets the individual title. The larger consequences, aside from better agriculture, are many. The enterprising and thrifty peasant will get on and prosper, while the shiftless will lose what land he has. There will be created in Russia a new class of small but independent farmers on the one hand, and an agricultural proletariat on the other. That the latter will sooner or later find its way to the cities and supply the much needed labor for the steadily growing industrial Russia is also clear. This however is the very reason for the violent opposition to Stolypin's reform by many leading statesmen and economists, who point with pride to the fact that up to the present Russia has not had a class corresponding to the industrial proletariat of western Europe.

For years the appalling losses through fire in the Russian towns and villages was a matter much commented on, but no effort at prevention was seriously undertaken. Stone is scarce throughout Russia for the geological strata are horizontal, hence the houses, barns and other buildings are of necessity constructed of wood, clay, brick and straw. The rural villages present a jumble of thick thatched roofs as inflammable

in dry weather as tinder. According to the findings of a government commission appointed a few years ago to investigate the subject, the losses to the nation by fire amounted to the total destruction of rural Russia once in fifteen years.. The report was the incentive for a vigorous campaign against the thatched roof, with the result that in many villages one can now see the new roofs of wood or metal side by side with the thatched. They are less picturesque but manifestly better, and the change is going on rapidly.

The villages are usually unattractive. Where possible, they are built on low ground, probably as a protection against the cold. The streets and alleys are not paved and in rainy weather they are deep with mud which makes them not only impassable, but owing to the lack of sanitary precautions, a breeding place for disease, especially for typhoid and diphtheria. The death rate is of course appalling. Indeed the question of public health is sadly neglected. In 1909 there was only one doctor for every 11,000 people in the Empire. In the villages of some pretension, one is apt to find a house a little better than the rest that serves as the inn, hard by is the store where necessities are sold and at the end of the village street, or not infrequently back of the individual cottages, is the bathhouse in which the villagers bathe or steam themselves at least once a week.

The building of the village that one would like to find, and rarely does, is the village school, which is so conspicuous in the rural landscape of America and western Europe. Up to the present the Russian seems to have expended his energy in building churches instead of schools. Wherever you go in the land of the Tsars, the existence of an all powerful dominating church is manifest. The sky line of the great cities is dotted with the brightly gilded domes of cathedrals and monasteries, while the country landscape is likewise enriched and enlivened by the presence of the white sobor of the region. Similarly one encounters in the streets of every large city innumerable shrines. The mass of the population still makes the sign of the cross and utters a prayer when passing a church or shrine. In the hut of the peasant as in the palace of the rich, and on every vessel flying the Russian flag, the holy ikon above the little burning lamp with floating wick is always found.

The Russian church ever since the days of Peter the Great has been a state institution. Its clergy are the servants of the state, and it is therefore very closely identified with the government in its administration and policy. The clergy is sharply divided into two groups, the black and the white or grey. The former are monks; they do not marry and from their ranks come the higher clergy. While in the monasteries they occupy themselves with the complexities of the Slavonic liturgy and service, works of charity, painting of ikons, etc., the demand being

of course enormous. Unfortunately the state described by Turgeniev as "remorseless laziness" is quite as prevalent with the monks as with the peasants.

One of the greatest things the clergy has done for the Russian people is the creation of a wonderful church music. The singing and intoning is all by male voices and in some of the churches, as for example, St. Isaacs at Petersburg, or the Synodal Church at Moscow, surpasses in dignity and grandeur any church music in the world. Nothing, it seems to me, can excel in exquisite beauty the singing of the *gosopodoy lui,* the Russian for "God have Mercy" from the moment the first notes of the boy soprano reach you, through the manifold variations to the final appeal by the full chorus to which the deep rich Russian bass gives a power almost of command. Russian music, whether it be the fine liturgical music of the church, the rhythmic and somewhat monotonous singing of the Volga boatmen, the boisterous Troika song, or an ornate opera like Boris Godunov, is permeated through and through with the spirit of the endless plain and a sense of loneliness that rarely admits of majors. The somber hues of the landscape, the atmosphere of the boundless solitudes, dominate; Russian popular music is all in the minor key.

Whether it be the result of ignorance, isolation or climate, the bane of the Russian peasant is intemperance and the amount of vodka he consumes is appalling. The manufacture and sale of the drink is a government monopoly. There are two grades, the best containing about 40 per cent. alcohol. It is a white liquor with a cognac taste vitiated however by an after taste of crude oil which the wealthy Russian overcomes by adding a little palatable sherry. To such an extent has the drink habit grown that the government's revenue from this source last year reached the enormous sum of 800,000,000 roubles or somewhat over $400,000,000.

So threatening has the drink evil become that strenuous efforts have been undertaken to check it. Since the beginning of the war the Tsar has prohibited the manufacture and sale of vodka entirely. That a deep-seated national custom will not be corrected by an edict is evident. Intelligent efforts are, however, being made to bring about the emancipation of the people in this respect. Whatever the outcome of these efforts, the drunkenness of the Russian masses in the past has been proverbial. With this has gone a brutalizing of human nature; men still beat their wives and children apparently for no other reason than to keep up the ancient tradition.

But in this respect too conditions are changing. Indeed it is becoming a commonplace that even the Great Russian is far from being quite so absolutely the master in his house as he used to be. In place of the old folk-song by the young wife: "What sort of husband are

you to me? You do not pull my hair and you do not strike me," one now hears the complaint of the old-fashioned: "God only knows what is getting into our women these days: You can not lay a finger on them without their shouting and making an ado, saying they will go away and not come back." That the amelioration of the lot of woman in Russia has been so long delayed is a matter of surprise, because if Russian writers are fair to their men, the Russian woman is in every respect more practical, energetic and effective; "the incarnation of singleness of purpose" and possessed of a driving force that is only equalled by the irresolution of the male sex. In Finland she sits in the Diet of the nation, in Poland the women more than the men keep alive the fires of Polish patriotism, and in Russia proper they are an important element in the progressive movement.

For several decades an industrial transformation has been in progress in Russia that has largely changed the character of the chief centers of population. While still predominantly agricultural, Russia is rapidly becoming an industrial state as well. There has been a tremendous growth of manufactures in recent years. Hand in hand with the growth of factories, especially those of the iron and textile industries in the cities, there is also a very extensive system of manufacturing on the large estates where the work is done by peasants. With this has come of late an extensive system of encouragement of domestic manufacture, or cottage industry among the peasantry, still prevalent everywhere throughout the central provinces of European Russia. In the textile industry the hand manufacture often cooperates as a direct auxiliary with the great mills of Moscow and Petersburg. An enlightened effort is also being made to perpetuate native or home industry by patriotic societies; stores and agencies are maintained for the woodwork, bric-a-brac, toys, wicker-work, leather goods, pottery, lace, embroidery, etc., made by the peasants during the long winter.

Perhaps the most important factor in this transformation of Russia is the modernization of the transportation of the country. Unfortunately too much emphasis is laid on military interest as opposed to economic needs in the construction of Russian railroads. The foremost English authority on Russia writing ten years ago said,

> When a great enterprise is projected, the first question is—"How will the new scheme affect the interests of the state?" When the course of a new railway has to be determined, the military authorities are among the first to be consulted, and their opinion has great influence on the ultimate decision. The natural consequence is that the railway-map of Russia presents to the eye of the strategist much that is quite unintelligible to the ordinary observer—a fact that will become apparent even to the uninitiated as soon as a war breaks out in eastern Europe.

At the time of the Crimean War, Russia had 750 miles of railroad; in 1913 the Minister of Ways and Communications gave the total

mileage as 46,839, of which 60 per cent. belongs to the state. Russia stands next to the United States in mileage. And added to this is the enormous extent of her navigable waterways aggregating 102,600 miles. On the whole Russia combines a most marvellous system of transportation, almost bewildering in its variety of medieval and modern traffic methods; caravans, motor-vans, barges, vessels with internal combustion engines and up-to-date steam railroads.

The center of the system is not Petersburg but Moscow, the city also most intimately identified historically with the rise and growth of the nation. There are only two important economic areas of Russia that Petersburg can reach without passing through Moscow, and even these are more closely allied to Moscow than to the northern capital. Geography, and by this I mean location as well as resources, has not only kept Moscow on a level with her rival, but guarantees without gainsay to raise her far above the city of Peter in the future. The economic progress of the present and even more so of the Russia of to-morrow lies not in the region of Petersburg but in the center and south, that is nearer Moscow. The industrial areas from Poland to the southeast through Tula, Ekaterinoslav to the mines of the lower Don, the largest coal-producing fields of Europe; the Baku oil fields; the Caspian and lower Volga fisheries; the Transcaspian trade; the commerce of the Black Sea and the Bosphorus; and the proximity of the Moscow government to the great agricultural area of the Black Earth Belt, all afford a sound economic basis for the supremacy of the old capital. Before her the bureaucratic city on the banks of the Neva must sooner or later surrender an ascendancy made by man in defiance of geography. Besides, the movement of population in Russia is southward. Incidentally too it is worthy of note that the development of industrialism and commercialism at Moscow has already transformed the politics of this cradle of autocratic Tsardom; Moscow is no longer reactionary but progressive and liberal.

The progress of Russia has been tremendous in the last decade. The years since the Japanese war have seen the adoption of a constitutional régime, the rapid spread of industrialism, the greatest agrarian reforms since emancipation, and a remarkably intelligent study and handling of the problems of primary education, agriculture and intemperance. Along with this has come a clear appreciation of the richness of her resources. "In the markets of the world there exists to-day a famine in meat, lumber and breadstuffs," say the Russian economists, and Russia can produce all three to an indefinite amount.

Russia has a geographic basis for a great nation such as is possessed by no other people unless it be our own. It is wanting however in one important respect, it lacks an adequate coast line. Its outlet to the commerce of the western world is through waters dominated by

other powers, or by way of Archangel, which, like Petersburg, is ice-bound for a large part of the year. Nor are conditions better in the Far East where the premature insistence upon the possession of Port Arthur and the consequent war with Japan was largely due to the desire for an ice-free port on the Pacific. Russia's means of access to the world's commerce are too circumscribed for so large a state, and she is bound to demand a readjustment favorable to her interests from time to time. Indeed that is what she has been doing for centuries; her coastward movement has been in progress for at least four hundred years and we are witnesses to-day of another gigantic step in this direction. The Germans block the way, and ultimately, combined with them, the Swedes and Danes. That Russia with her population of 175 millions, increasing at the rate of nearly three millions a year, and with resources so vast and undeveloped that they can only be roughly estimated, will be kept permanently bottled up is not likely. Her coastward advance, however, is likely to follow lines of least resistance and the conquest of an outlet by way of Constantinople to the world's trade is as inevitable as is its geographic reasonableness. Towards the Persian Gulf the way is also open and inviting. Indeed everywhere in Asia she has the unique advantage of internal lines of development and therefore also of attack. Geographically the serious menace to British world supremacy does not lie in Germany but in Russia.

In the past great rivers and flat plains invited expansion over immense areas of forest, swamp and rich agricultural lands. To-day the lure of rich trade routes and the consequent attraction of the sea is fascinating the eastern Slav. He is building his roads, railroads and canals, and sending colonists out into unoccupied land very much as did the United States in the nineteenth century. Once this is occupied, the push to the sea will be irresistible. This youthful giant among the nations of the world is beginning to realize his great strength; the resignation and despair of the peasant empire is giving way to a New Russia full of confident assurance.

GEOLOGICAL METHODS IN EARLIER DAYS

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WHILE reading discussions of modern field and office methods, published in *Economic Geology,* I became impressed with the feeling that some notes, historical and reminiscent, respecting conditions and methods of forty and more years ago, should be placed on record for the benefit of the younger geologists. The reminiscences are confined to my own experience, which, however, did not differ from that of contemporary workers.

Popular interest in natural history was quickened, early in the nineteenth century, by the formation of societies and the founding of museums. Efforts to secure cooperation by the central government were so far successful that surgeons accompanying exploring expeditions, in charge of army officers, were chosen as much because of willingness to act as collectors as because of medical skill. Very soon, natural history came to be regarded as, at least, lending dignity to an expedition's work, so that an army-explorer looked upon his equipment as defective unless it included a naturalist; a report without an appendix or a series of appendices, discussing collections secured by the party, seemed to be painfully incomplete. After the first third of the century had passed, geology acquired some degree of popular respect as a practical science and it received recognition from the War Department. The making of geological observations became part of the duty assigned to the naturalist-surgeon. In almost every case, however, the work of the naturalist or geologist was merely incidental and his opportunity to obtain detailed information was limited.

In the later sixties, after the close of the Civil War, the War Department, through the corps of engineers, began exploration anew. Clarence King's organization was under this Bureau, but he was not subject to military control in the field; his only hindrance was the pressure for results to prove speedy productiveness and to satisfy inquiring legislators that the field-work had not been merely a prolonged picnic. Somewhat later, an organization of the earlier or reconnaissance type was effected and was placed in charge of Lieutenant George M. Wheeler, who was endowed with extraordinary energy and with such physical endurance as to be a source of pain to all members of his party. In 1872, Wheeler became convinced that, without geological and other scientific contributions, his work would be incomplete, for Hayden had already loomed large on the horizon. The scope of the organization was

enlarged and G. K. Gilbert, with E. E. Howell, was appointed, each being attached to a party as geologist. In 1873, there was farther enlargement and a party was formed to map and to explore about half of the mountain region of Colorado, with as much of New Mexico as possible, an area of not far from 30,000 square miles, containing much extremely complicated geology. J. J. Stevenson was assigned to this party as geologist. The party consisted of Lieutenant (now Brigadier-General, retired) W. L. Marshall, two topographers, three "scientific workers," an imposing array of packers and an escort of 25 infantry soldiers, who were to serve as protection against Indians. There were some good men in this escort, but before the season was well underway, there seemed to be reason for supposing that the authorities at Fort Leavenworth had unloaded their guardhouse on us. Ninety six mules of varying temperaments completed the equipment.

The request for a large appropriation from Congress had been enforced by proof that the work of previous years had been done at an almost incredibly small cost per square mile—and the argument was effective. The work in 1873 was to be an improvement on that of the past but the importance of economical operation was not to be forgotten. The geologist received a small mountain aneroid, a clinometer compass, a pocket level and a hammer; the naturalist-surgeon was equipped with a Spencer carbine of large bore, that he might shoot birds and other small animals; the collector in botany had his presses; the youthful barometer-carrier had his burden strapped on his back; the expedition was ready to start. After a series of misunderstandings with the mules, one of which led to a stampede which startled the youthful city of Denver, the party set forth in single file, as is the manner of mules.

The geologists associated with the Wheeler organization had gained some experience in the field, chiefly in connection with the Ohio survey, and they had gone with Wheeler in search of a wider field of usefulness. The field of the Colorado party proved very useful to me, but very soon I had misgivings as to my usefulness in that field. It became evident very quickly that geography, not geology, was the objective, and that the important elements in equipment of a geologist for this work were a lively scientific imagination and ability to solve stratigraphic puzzles by intuition. There was no map and the topographer's notebook was of little service. The direction of travel was determined by conditions, so that, without a map, one could not keep his bearings in the maze of valleys and cañons. The topographer was always secure, as the expedition was for him, but the geologist was in constant uncertainty. If he saw a section, which might relieve his perplexity, he was in anxious concern, knowing that if he measured the section, the train would disappear and he might be as a man hunting the needle in a haystack. But he had to secure sections, he had to examine anomalous exposures,

and afterwards he had to find the train. The conditions made for rapid movement when at work, for keenness of observation, for quickness of perception, for promptness in decision as well as for error in conclusion. The geologist learned to follow the track of the train, but the close watch for crushed grass or for fleeting footprints in sand prevented him from seeing important features during his hasty ride.

In comparing the work of the earlier days with that performed more recently, under better conditions and with the aid of the earlier reconnaissances, I have been astonished that so much, and the word is used advisedly, has endured the test of friendly as well as of unfriendly criticism. It is surprising that geologists, slung about as bobs on the tail of a topographer's kite in a wholly unknown region, succeeded so well in gaining knowledge of the general structure; they failed only where they attempted detailed description or discussion. Maps were prepared slowly after the season closed and when the geologist received them, a year or more afterwards, they were a mystery. Streams followed wholly unsuspected directions; localities were in relations very different from those conceived when the work was in progress; in critical places the map was altogether unlike that drawn in the geologist's mind. It was impossible to bring the imagined into harmony with the real, so that some portions were colored on the basis of a mental reconnaissance. Geologists attached to the Hayden survey were at somewhat less disadvantage because the work was primarily geological; but they were hampered very seriously in other directions. In those early days the importance of surveys was not recognized; in order to secure appropriations it was necessary to produce bulky reports referring to great areas; there was no time for careful work, yet several geologists associated with Hayden made remarkable studies and solved intricate problems. The Powell survey, because of the Major's marvelous skill in manipulation of Congressional committees, was hampered much less, and the work done by Gilbert and by Dutton is of lasting importance.

Geological surveys in individual states were begun very early but, except in Massachusetts, they were shortlived and on a small scale. The great surveys of New York, Pennsylvania and Virginia were begun in 1836. At that time, there were practically no geologists in the country; of those known as mining engineers, not more than five or six had received any geological training. The geological surveys were entrusted mostly to young men; Rogers of Virginia was 32; his brother in Pennsylvania was 28; in New York, Mather was 32, Vanuxem was 44, Emmons, 37 and Hall, 25. Among the assistants on the Pennsylvania survey were Lesley, 20, Hodge, 21, Jackson, 23, Haldeman, 24. The country in much of Virginia, Pennsylvania and Ohio, even in New York, was little better than a wilderness, eighty years ago; railroads

were practically unknown and there were few graded roads; aneroids were mere toys and Locke had not invented his pocket level; there were no instruments except those of cumbrous size; boiling point thermometers were tried but they proved worthless; there were few maps and such as did exist were misleading. The young men, without previous training, without instruments of any sort, except a compass, and without maps, were thrown into the unexplored region. It has been my privilege to reexamine much of the area in which they labored. How they obtained their results passes comprehension; they carried the Bituminous section in Pennsylvania and Virginia with wondrous accuracy, though at times there were intervals of miles in which no exposures existed except along streams flowing through the woodland. It is easy now to discover inaccuracies in their work, for men can examine it, so to speak, with a microscope. These early geologists, for the most part, were men of gigantic intellect and noble integrity.

With the close of these surveys in 1842 to 1845, extended work came to an end. Some organizations were continued in a moderate way, but all except those of Illinois and New York were broken up by the Civil War, and there was no revival until the later sixties. Meanwhile the condition existing in 1836 had returned. Not more than 30 men survived who had been trained in field work; some of these had gone into special work as mining engineers, others were in enfeebled health, and others still were in positions less onerous and more remunerative than survey work. Probably not more than ten men were available in 1869, and several of those were attached to surveys not interrupted by the Civil War.

The Ohio survey, reorganized in 1869, had as its director the veteran Newberry, who, as a young physician, had entered the United States service during the Pacific Railroad explorations. As a lad he had collected fossil plants from the roof of his father's coal mine in Ohio, and in later years he had studied paleobotany under Brongniart in Paris. His work as geologist, botanist and zoologist on the Pacific Railroad explorations was brilliant, but in importance was far excelled by his later geological work on the Ives and Macomb expeditions. Of his assistants on the Ohio survey, only one could be regarded as a professional geologist; the others were amateurs. Of the aids and coworkers, not more than three had done any field work and the most of us were wholly inexperienced. We were expected to succeed without help, as our predecessors had done; an area was assigned to each man and he was told to get at it. The state maps were good, but on a small scale; the general structure had been worked out by the Mather survey long before, and both Newberry and Whittlesey had published small outline maps; but, as far as details were concerned, the region was a *terra incognita.*

Did we make blunders? We simply reveled in ignorance; we learned by making mistakes and by occasionally discovering some of them. We did not know for what to look, but we looked at everything, for everything was a revelation. Some of the worst errors in correlation were due to this. On my third day, while day-dreaming over what seemed to be a remarkable phenomenon, I lost hold of the section, and in crossing the divide committed an error which affected my work throughout that summer and the next. There was no opportunity for revision; the western method of reconnaissance prevailed and a line once covered was completed. The young men, who did the work for their expenses, gained a vast amount of knowledge but not much modesty; they had been found capable of doing a new type of work without assistance. The rod of correction was applied somewhat more than ten years later by Professor Edward Orton, Sr., but the application was made so gently, so courteously, that all of us were united in gratitude to the keen man who had harmonized conflicting observations and had corrected errors, but had administered no rebuke to the incompetent youths who had made them. Economically, the errors were unimportant as they were chiefly in correlation; the resources of state were described well and the observations were recorded honestly. A group of geologists were trained, who, under Orton during the third survey, knew for what to look, how to look for it and, better still, how to present their results.

The second survey of Pennsylvania was ordered by the Legislature of that state in 1874, forty years ago, and J. P. Lesley was appointed as director. Though a survivor of the first survey, discontinued more than 30 years before, he was still in the prime of his powers and, along certain lines, he was perhaps the ablest geologist in the country. But he had entered from the topographical side and all his work had been concerned with economic applications of geology. The survey had been ordered on an extensive scale that the mineral resources of the state might be determined in practical detail, so that it was necessary to publish prompt and somewhat voluminous reports in order to suppress recalcitrant legislators. In 1875 I was appointed geologist in charge of the southwestern district and entered upon the work with I. C. White as aid. It may be remarked in passing that, in state work, the geologist must contend with one serious cause of error which is unknown to the western explorer. Sleepless nights were rare during the western work, but in the civilized region, where one must live off the country, there is often the terror that walketh in darkness, which benumbs the geologist's intellect and blinds his eyes during the day.

Thirty-five years prior to our advent, Henderson had completed his work for the first survey and had reached the conclusion that, owing to lack of exposure, the upper part of the section would never be worked

out. During that interval there had been no change in conditions except that the region had been stripped of forest and numerous rude country roads had been made. There was no railroad, except at the extreme north; there were no extensive mining operations except on the Pittsburgh coal bed on the Monongahela River, and there were no records of oil borings except in the southeast corner where they were not needed. To add to the natural drawbacks, we were equipped with aneroids which were fearfully and wonderfully made. Lesley, unable to induce Becker to make a supply of high grade barometers, had procured a number of models to be tested. Those assigned to us were shaped like a hat box and were provided with vernier and other attachments, all of which had to be cared for at each reading, as otherwise the observation would be wholly worthless. Happily for us, our horses ran away one day; when the race was over and White's horse had won, we discovered with grateful hearts that the barometers were ruined. Thereafter we used our own barometers, which proved to be fairly good.

As soon as we had passed beyond 100 feet above the Waynesburg coal bed, satisfactory exposures became rare—and nine tenths of Greene County, in which we had begun, was above that horizon. The only recourse was to examine every bit of rock that jutted out on a hillside. Sections were made everywhere, 5 to 100 or more feet long, but the longer ones had tormenting gaps which refused to be filled. Strange anomalies appeared, which cast doubt on tentative correlations; limestone was found where we expected variegated shale; streaks of coal appeared in what seemed to be wrong positions; sandstone was seen where there should have been a coal bed. Our work proved that these are not anomalies and the conditions are commonplaces to-day; but 40 years ago the continuity of deposits was a cardinal doctrine and all limestones were marine. Our conversion was slow but it came, and little by little we were able to piece the fragments together; the section was completed as far as possible and doubt remained respecting only a few horizons, which were not economically important.

It would have been well if several localities could have been reexamined; a number of errors would have been eliminated which now are so evident that any one can note them. Revision is very different from original work, and is a very simple matter. If the original observer has recorded his observations honestly, the reviser needs no especial acumen in order to discover the errors. If White and I had had the advantage, 40 years ago, of the hundreds of oil-well records made in the Greene and Washington district during the last 20 years, our work would have been a holiday jaunt; we should not have been compelled to spend so many dreary days in securing fragmentary sections or so many weary nights in trying to combine them. But there were no well records and there was no opportunity for revision. Too

much time had been spent in Greene; there remained the larger county of Washington and a great part of Allegheny to be studied.

The problems in Washington, though different, were equally perplexing for a time. Exposures were better, longer continuous sections were secured, but new members came in while familiar ones dropped out. We were firm believers in variation of intervals between coal beds, but were not prepared for the variations which had been accomplished in the deeply buried portions of the section within northern Greene and southern Washington and which were revealed under an anticline in Washington. The imperfect record of a coal shaft reaching the Pittsburgh coal bed removed all doubts and filled us with intense respect for such records. The work in this county was not difficult as the section had been mastered; the especial burden being to cover the region in detail before snowfall, as the report must be ready for the printer before adjournment of Legislature.

During this season's work our attention was concentrated upon correlation and economic questions; there was no time for studies concerning matters of purely scientific interest. So intent were we in consideration of those subjects that we neglected to make notes of features which are all-important in their bearing on problems relating to coal and coal beds. Having sinned in this way, it is not for me to cast stones at any one for a similar sin, provided it has been committed under similar conditions.

A serious difficulty encountered by geologists in the earlier work was the inaccuracy of maps. One illustration suffices. In Fayette and Westmoreland Counties of Pennsylvania, I made use of maps which the county surveyors regarded as the least inaccurate. Professor Lesley had done some geological work in those counties and had discovered defects in the maps, which disturbed him greatly. He chose worse maps, corrected some errors in them and transferred my outcrop lines to the new base. The creations were put on the stone and proofs were sent to me. A single glance aroused feelings too deep for utterance and the proofs were returned without change. No doubt many other geologists can relate a similar experience.

Geologists, entering on field work within the last score of years, know little of the difficulties attending exploration forty or more years ago, especially in coal areas, where the effort was to trace thin deposits throughout extensive areas; though exception should be made in favor of those laboring in similar areas at the far west, where dependence must still be placed on natural exposures. In by far the greater part of the country the structural geology has been worked out during more or less reconnoissances, so that when the reviser entered the field he found everything so simple that he was astonished that any one should have been perplexed and still more astonished that mistakes were

made. The structure of the Elk mountains in Colorado is distinct and every feature stands out so sharply that a child in geology can read the story. But the case was very different before W. H. Holmes recognized in the crumpled mass of fragments merely a crushed, faulted fold and restored the original lines. The symmetry of the Jura mountains is the admiration of geologists, but the key to unlock its case of mysteries was not found until H. D. Rogers, fresh from his Appalachian studies, proved the simplicity of its structure. The older geologists made our geology. In most of the United States, Canada and Europe, the share of recent geologists is like that of workmen who fill up cracks in the walls and interior of a building and put on the finishing touches, that the edifice may be the better fitted to resist the ravages of time.

The writer is not of those who believe that the older days were better than these or that the geologists of half a century ago were superior to those of our own day. Such a conception would be arrant folly. But he is convinced that in some respects the work of too many geologists is defective and that the cause is not hard to find. The methods are too refined and dependence on them tends to make the process too mechanical. The older geologists had practically no appliances except their eyes, and comparatively few of them had more than a passing knowledge of topography. The contrast appears sharply in the reports. The writer, in endeavoring to ascertain conditions prevalent during deposition of coals in the United States and Europe, has examined carefully scores of thousands of pages in several languages, so that he writes feelingly. Within recent times the tendency has been to record chiefly such observations as have the accuracy of instrumental determination. Other matters seem to be unimportant; they are commonplaces, unworthy of record. Yet those commonplaces are the essentials of pure geology. Certainly, one is justified in asking that men who have only to revise, with the aid of later developments, the work of other men, should add greatly to knowledge in the province of pure geology. It is more than probable that the demand for economic facts dulls the vision for other things, as it did too often 60 years ago, but there is room for protest against continuance of the condition. One may be pardoned for expressing the conviction that the weird work of Land Classification for the United States is likely to be, as it were, a red-hot iron rod passed close to the eyes of probably the ablest corps of geologists this world has known.

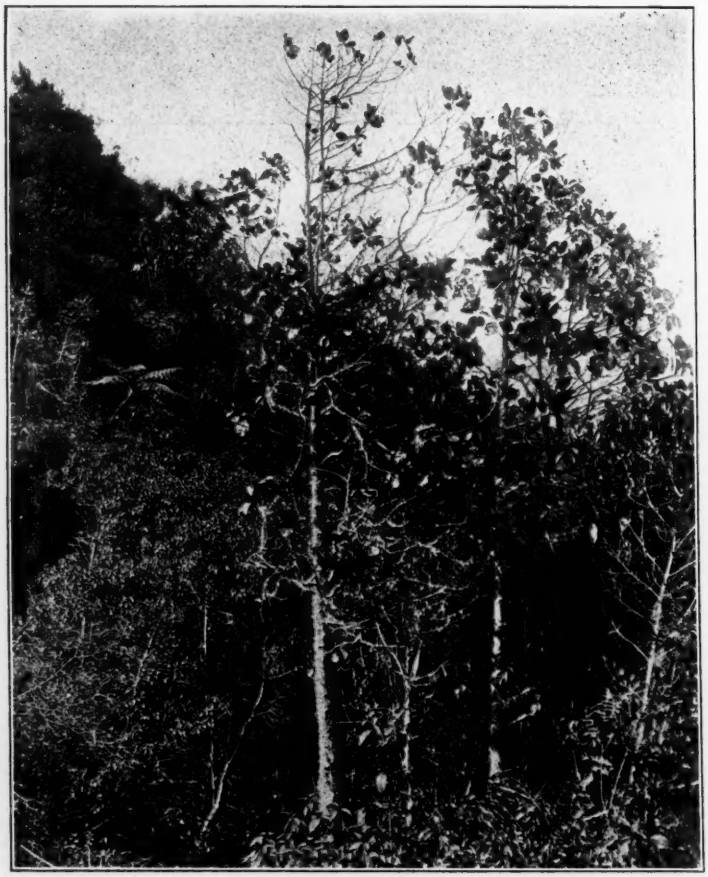
THE CINCHONA BOTANICAL STATION. II

By Professor DUNCAN S. JOHNSON,
THE JOHNS HOPKINS UNIVERSITY

The Native Vegetation of the Cinchona Region

The native flora of Cinchona Hill is a varied and interesting one. Being south of the mountains, and on a sharp ridge with perfect drainage, the soil often gets quite dry. Especially is this true of the small pockets of humus in the rock clefts occupied by the numerous rock xerophytes, and of that gathered on the limbs of trees or held among the clustered roots of epiphytic orchids. We find here, therefore, many species characteristic of these xerophytic habitats. There are century plants, leathery-leafed ferns, aroids, bromeliads, orchids and *Peperomias* growing in the clefts of the rocks and on the branches of trees and shrubs. Climbing or creeping ferns, aroids, orchids, milkweeds and cacti run over the ledges and larger plants. On the branches of the juniper and *Dodonaea,* of the thick-leafed *Vaccinium,* and even of the nearly leafless *Baccharis* on the dry hillsides, many species of leafy or

Cliff with Xerophytic Plants. A century plant in its native home.



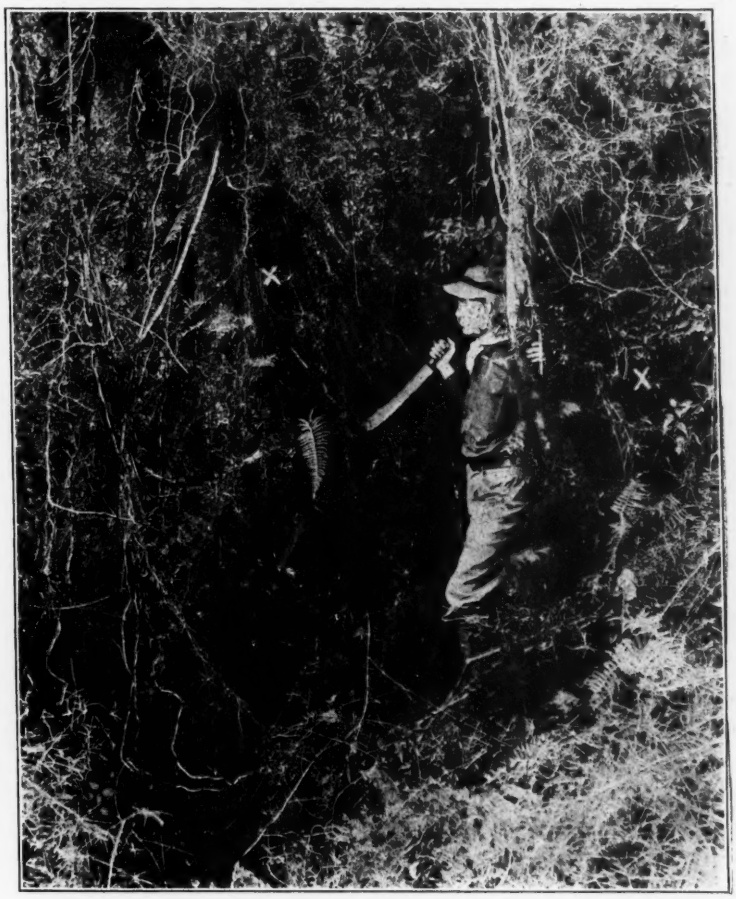
TWO CINCHONA TREES.

cactus-like mistletoes are thickly scattered. These half parasites win out in the struggle against drouth by allowing other plants to find water for them.

In the moist hollows, or on northern slopes of Cinchona Hill, many plants of temperate zones have established themselves, being brought there, presumably, with vegetable seeds imported from England. Clover, dandelion, dock, mullein, plantain and yarrow grow beside the trail. Wild strawberries bloom and ripen throughout the year. Side by side with these old acquaintances are thick clumps of the spicy-flowered wild ginger, and, towering over them are orchids and begonias as high as the head, canes and bamboos twenty feet tall, gray-barked, red-leafed cinchona trees and brilliant-flowered Melastomaceous shrubs. The lantana, Cherokee rose, passion flower, prickly-leafed ferns and the wiry-stemmed grass *Chusquaea* clamber over every thicket. Ferns abound everywhere, in sun or shade, and in moist or dry situations. Along one trail from

Cinchona, toward the mountains, a hundred species of ferns may be seen in an hour's walk without leaving the path. Professor Underwood estimated that four fifths of the 500 species native to Jamaica occur within a day's ride of Cinchona. We may well note, by way of comparison, that but one hundred and fifteen species are given in Gray's Manual for the whole northeastern United States.

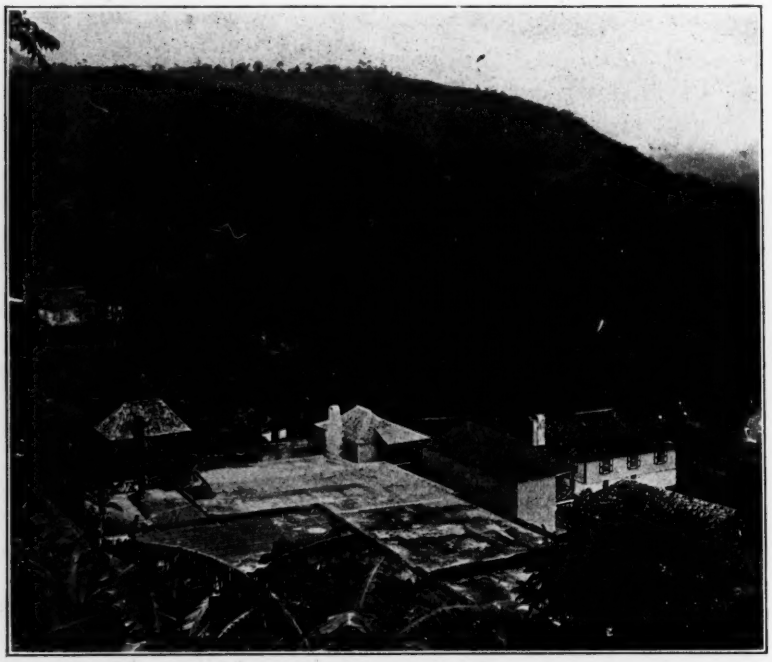
Lower down, for we have been speaking hitherto of the levels near that of the Cinchona residence, the vegetation on this south side of the Blue Mountains becomes more luxuriant in the valleys and more xerophytic on the ridges. In the former the trees, such as *Alchornea latifolia* and *Prunus occidentalis* grow to a height of 60 or 70 feet, and lianes, such as *Maurandia, Begonia, Rhynchosia* and *Bidens* climb to their tops, while a new series of ferns and shrubs make up the undergrowth. On the ridges also the plants have a different aspect. There are new species, to be sure, but even the same species, *e. g.*, certain ferns,



EDGE OF FOREST. *Polypodium, Chusquaea* (at ×) and other climbers.

that in the damper regions above may be two feet or more in height, are reduced, on the exposed rocks of the hotter lowlands, to pigmies of but two or three inches when mature.

On hundreds of acres of the rocky hillsides for 2,000 feet below Cinchona is raised the Blue Mountain coffee, which Jamaicans, and the London coffee tasters, say is the finest coffee in the world. The coffee beans, the seeds of a small Abyssian tree related to *Cinchona,* are borne, two together, in each of the bright red, cherry-like fruits. The trees are grown on the steep, rocky ground, with oranges or bananas scattered in



COFFEE PLANTER'S HOME WITH CEMENT DRYING FLOOR (BARBECUE). Pulping mill and windrows of drying coffee at left.

for shade. They are cultivated entirely by hand and are pruned down to five or six feet for convenience in picking the berries. The coffee beans are freed from pulp, shelled out of the parchment after drying, winnowed and polished, sometimes by gasoline engines, but usually by water power from the mountain streams. The beans are then sorted to sizes by screens, culled over by hand, and sent to Kingston, 15 or 20 miles away, on pack mules. Other parts of the cleared ground below Cinchona are planted with vegetables by the negro natives. These temporary tenants clear the land, raise potatoes, cabbages, scallions (onions), beets, yams and coco root, for three years on it and leave it with a good set of young coffee trees in payment for the lease.

Two miles north of Cinchona and at the same level, 5,000 feet, there is a notch in the main mountain range known as Morce's Gap. As one passes northward through this gap one sees the aspect of the vegetation change with surprising suddenness from that characteristic of the immediate neighborhood of Cinchona. Here, on the windward side of the mountains, everything reeks with moisture, for during most of the year clouds or mist drift through these gaps continuously from the cool north side of the mountains. Rain falls almost daily for much of the year,

BERRIES AND FLOWERS OF COFFEE.

and even when it is not raining the clouds form and float through these dark forests. Ferns are in their glory here in this dense montane rain forest. There are scores of tree ferns, of half a dozen species, with stems three to six inches thick and ten to thirty feet high. Their straight slender trunks contrast strikingly with the forked, twisted branches of the *Podocarpus,* prune and other trees among which they are scattered. Most of the trees on some half-acre patches are tree ferns of the genera *Alsophila* or *Cyathea.* Their beautiful umbrella-like crowns are seen best from a hillside above them, or when their delicate plumes are outlined against the sky. Under these ferns and the other

TREE FERNS AT BOTTOM OF A VALLEY.

trees are *Marattias* and *Dunaeas*, with *Nephrodiums* and *Aspleniums* of many varieties. *Gleichenias* and *Davallias* fringe the trails, while *Lomarias, Trichomanes* and *Polypodiums* twine about the tree trunks and epiphytic *Acrostichums, Elaphoglossums, Polypodiums* and *Lycopodiums* settle on the stems or branches of *Cyathea* and other trees. The beautifully delicate *Hymenophyllum* and *Trichomanes* form thick carpets over damp cliffs, and over living or dead trunks. Even high up on trunks or branches they may form dense tufts or lace-like curtains. These filmy ferns here take the place, in part, of the mosses of our northern forests, on soil, rock and trunk. But the mosses themselves are here also to war with their competitors for standing ground and sunlight. Mingled with *Collema* and other lichens, the mosses form spongy tufts

over trunks and branches clear to the tops of the trees. Other species hang from the trees and lianes in festoons a yard or two in length.

The seed plants also of this rain forest show the same diversity of habit. There are dozens of climbers and twiners, such as *Bidens, Marcgravia, Sciadophyllum* and *Rhynchosia,* which cling to the trunks of the larger trees and so make their way up to the light. The *Marcgravia* is especially interesting from its possession of honey cups, which tempt the humming-birds that accomplish the pollination of its simple, inconspicuous flowers. Scores of bromeliads and orchids, as well as the ferns mentioned above, have become air plants, entirely without any connection with the ground. These epiphytes collect water and the solid food needed either from material falling into their cup-like leaf clusters, or absorb them as they drip down over the bark of the supporting tree. Indeed, *trees* of some size may find the necessary soil and water in the turfs of smaller air plants and the débris accumulated by them, even forty or fifty feet from the ground on the limbs of a big *Podocarpus.* The very leaves of trees, shrubs and of the more persistent herbaceous plants may become covered with epiphytic lichens and liverworts. In all these cases the air plants are not parasites, but simply use the trunk, branch or leaf as a standing place in which adequate light is available. In the lowlands we saw certain of these air plants actually flourishing on telephone wires.

If we go northward from Morce's Gap and down 2,000 feet into the

Marattia ON A HILL SIDE.

Podocarpus TREE AND TREE FERN BESET WITH EPIPHYTIC BROMELIADS AND FERNS.

Mabess Valley, we find a region of much higher temperature and of still more constant rainfall. Here the vegetation becomes even more luxuriant, and, though made up of similar vegetational types, it includes many new species of ferns, like *Rhipidopteris peltata* and *Lygodium volubile.* There are high-perched tufts of brilliant *Pitcairnias* on the ledges. *Canna* and its relative *Heliconia,* with the thatch palm, *Geonoma,* grow along the stream, while clumps of the beautiful Rubiaceous shrub, *Cephaelis punicea,* are scattered on the slopes higher up.

On climbing the high peaks near Cinchona, such as John Crow, on the west, or Sir John and Blue Mountain Peak, on the east, one finds still other interesting and novel vegetational features to enlist the attention. The trees on the ridges are bent and twisted. The more or less

horizontal branches are interlaced in a way that makes following the "trail" a rather perplexing combination of climbing over, creeping beneath and squeezing between the dripping, moss-covered trunks and branches. These experiences are varied, however, on other parts of the ascent, by slipping down, while attempting to creep up, the steep, grass- or fern-covered slope of a particularly lubricous clay. New forms appear with increasing altitude, many of them rarities. The tops of these peaks are occupied by low, gnarled trees of *Podocarpus Urbanii,* and by head-high, mistleto-covered bushes of *Vaccinium meridionale* and *Clethra alexandri,* or by wide stretches of the fern *Gleichenia* or the grass *Danthonia shrevei.* The northern slopes of these Blue Mountains, down to the 2,000-foot level, are practically unexplored territory, with no trails, except that skirting the Mabess Valley.

All the points here mentioned, except Blue Mountain Peak, are

TREE FERN WHOSE TRUNK IS COVERED WITH EPIPHYTES AND CLIMBERS.

within four or five hours' walk from Cinchona, and they thus offer the investigator very diverse specific and vegetational types within easy reach of the station. Any one of them also could be made a substation at which an investigator resident at Cinchona could carry on physiolog-

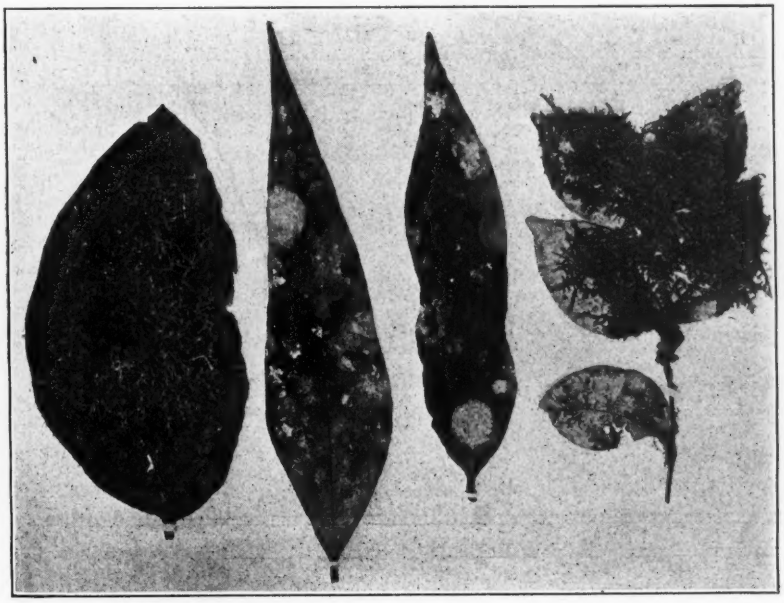
SWAYING TUFTS OF MOSSES HANGING FROM BRANCHES ABOVE YOUNG TREE FERNS.

ical or climatological work. Indeed, the variety of conditions available is far greater than has been indicated. Within half a day's ride from Cinchona a botanist can reach the steaming tropical lowlands of the north side of the island, the warm valleys and dry ridges of the southern slopes, and even the hot plains, coastal deserts, mangrove swamps and coral reefs of the south shore.

ADVANTAGES OF CINCHONA AS A TROPICAL STATION

It will make clear the unusual fitness of Cinchona as a tropical station if we here summarize its various advantages of location, surroundings, equipment and accessibility.

HANGING GARDEN. Twenty-five species of ferns and seed plants growing upon the limb of a tree forty feet above the ground. At left are the erect stems of two *epiphytics*.



EPIPHYTIC LICHENS AND LIVERWORTS ON LIVING LEAVES OF SHRUBS AND TREES.

CACTI AND GIANT MILKWEED, *Calotropis*, ON DESERT SOUTHERN SEACOAST.

COCOANUT AND MANGROVES (MATURE ONES IN BACKGROUND) ON SWAMPY SOUTH COAST OF JAMAICA.

In the first place it has that supremely important requisite, a primeval forest. There are scores of square miles of this within easy reach of Cinchona. It is only in such a forest that the extreme complexity attainable in a plant formation can be seen. Moreover, Cinchona is located in a botanical garden where scores of exotics are established, and where greenhouses, propagating grounds and helpers of some experience are available for collecting and growing material.

Secondly, because of the small size and irregular topography of the island of Jamaica, areas furnishing many varieties of conditions, from mountain peaks to coral reefs, can be readily reached from Cinchona. For example, there are about Cinchona 25 square miles of mountainous

A LEAFLESS SILK COTTON TREE BEARING NUMEROUS FRUITS. All the foliage in the crown of this tree belongs to the thousands of epiphytes on its branches.

country above the 5,000 foot level, and 140 square miles above 3,000 feet. There are also within reach river bottoms and sandy or rocky, desert or swampy sea coasts.

Thirdly, there are already two botanical gardens established in the lowlands where they can be used as substations for the study of problems concerning plants of these regions. One of these, Castleton, is in a damp region at 500 feet elevation, where it has a rainfall of 140 inches and a mean temperature of 75 degrees. The collection of plants here includes many ferns, cycads and screw pines, over a hundred species of palms, fine examples of *Ficus* and numerous other dicotyledonous trop-

ENTRANCE TO CASTLETON GARDENS. The palm above the gate (*Attalea*) has leaves ten yards long and two yards wide.

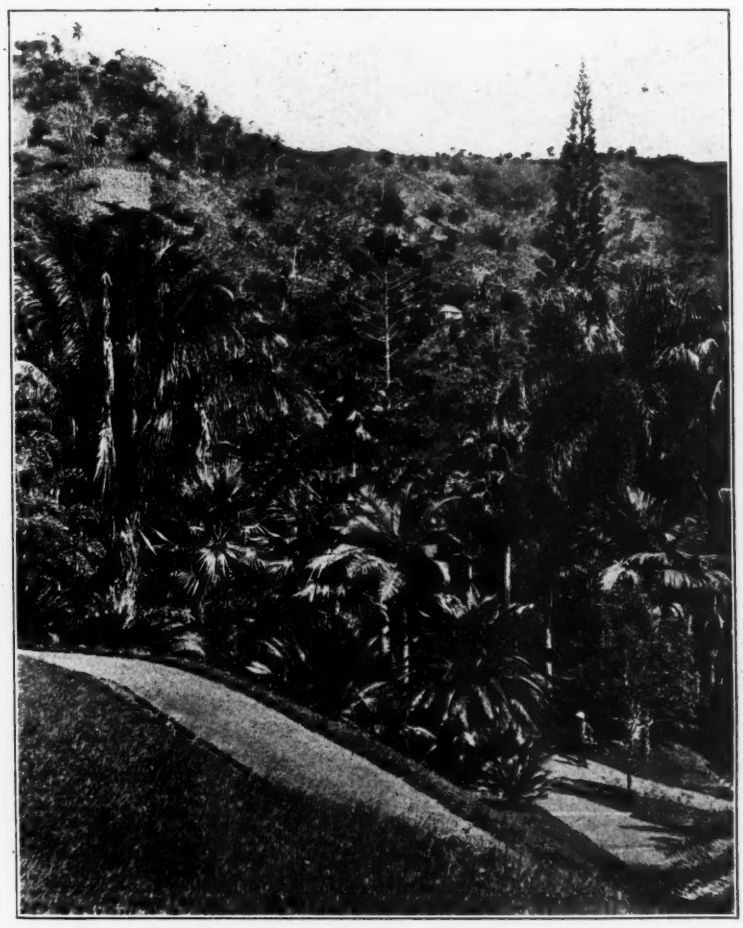
ical trees. The other garden, which is at Hope, is on the dry Liguania plain, slightly higher than Castleton, but with a mean temperature of 76 degrees, and a rainfall of only 61 inches. At Hope Gardens there are an excellent library, laboratory accommodations, and very interesting collections of living orchids, cacti and economic tropical plants. For one wishing to study the marine algae it would be readily possible to secure rooms or a building on the water front, at Kingston or Port Royal. It is probable also that a marine zoological station will soon be established at Montego Bay, and will be available for botanists wishing to study the algae of that region.

A fourth very important advantage of Cinchona is that it is located in the healthy highlands where the climate is stimulating for workers from the temperate zones; where the water supply is pure, and where malaria and enteric troubles are not to be feared. Professor Goebel, after having much experience in tropical travel, wrote, when advising the Tropical Laboratory Commission referred to above:

> If at all possible the main station should be in the highlands, with a subsidiary station in the lowlands or on the seashore for the study of the algæ, and the vegetation of tropical plains.

It means much also to workers of normal social instincts, especially to those who are to settle down at such a station for some months, to be

able to work in pleasant surroundings, and to have interesting neighbors outside the laboratory, when there may be few fellow-workers within. At Cinchona, with its comfortable house and delightful garden, with its splendid views of mountain and valley, of Kingston Harbor with its gliding ships and twinkling lights, the worker is assured of restful diversion for his leisure hours. Nor need he entirely lack pleasant association with his fellow man, though his nearest neighbors, coffee planters, are several miles away. The planter leads an active outdoor life in the invigorating climate of the hills, but he finds time for sociability, and at four o'clock he is indoors for tea. This custom is clung to as faithfully here as on the banks of the Thames. This is the time of day when one's next door neighbor, from two or three, or even from five or six miles away, rides over for tea, for a chat over the news of the Hills, or perhaps for a game of tennis. The temporary tenant of Cinchona may



CORNER OF CASTLETON GARDEN, WITH CYCADS, PALMS AND *Araucarias*.

always feel sure of a welcome at these neighborly gatherings. In fact he must needs be careful, if his collecting trip should take him across a plantation at tea time, not to be captured by the proprietor. Within the planter's home the visitor will find many of the comforts and some of the luxuries of modern life. There are books, magazines and newspapers that keep the planter in touch with the outside world. Often there is a piano, brought ten or fifteen miles over the mountain trails on the shoulders of negroes. Members of the family who play the instrument may often show good evidence of a training gained in England or on the Continent.

Finally, it is a matter of no small concern that a permanent tropical station for British and American workers, should be located in an English-speaking country, with a stable government and reliable sanitary control, and in one readily reached from the United States and Europe. Jamaica has the advantage of not being subject to revolutionary upheavals. Its quarantine against the entrance of tropical disease is strictly maintained, and there is a good postal service. There are 2,000 miles of good roads in the lowlands, and two of these already reach within five or six miles of Cinchona. Similar roads are soon to replace other of the well-kept bridle trails already built in the Hills. Thus by railroads, roads and bridle paths all parts of Jamaica are accessible from Cinchona. The island itself can be reached from the United States in four or five days, from five Atlantic ports, while the voyage from England takes but ten or twelve days.

We are to have available then a laboratory, readily accessible, and in a very favorable location, of which Professor D. H. Campbell, who has studied tropical vegetation in many lands, writes:

> I can think of no place where the fern vegetation is so rich and where other types of tropical vegetation are more accessible.

We believe the opportunity here offered will be more and more frequently embraced by botanists, and that this laboratory in the western tropics will doubtless, as was suggested by Goebel, "be of the very greatest importance to the science, and will give a strong impulse to the study of botany in America." Jamaica will then be honored among men of science for the maintenance of this laboratory, as Holland has been for the support of the famous station at Buitenzorg.

THE HARPSWELL LABORATORY,
August, 1914.

THE INDIAN'S HEALTH PROBLEM

By CHARLES A. EASTMAN, M.D. (OHIYESA)
AMHERST, MASS.

THE physical decline and alarming death rate of the American Indian of to-day is perhaps the most serious and urgent of the many problems that confront him at the present time. The death rate is stated by government officials at about 30 per thousand of the population—double the average rate among white Americans. From the same source we learn that about 70,000 in the United States are suffering from trachoma, a serious and contagious eye disease, and probably 30,000 have tuberculosis in some form. The death rate from tuberculosis is almost three times that among the whites.

These are grave facts, and cause deep anxiety to the intelligent Indian and to the friends of the race. Some hold pessimistic views looking to its early extinction; but these are not warranted by the outlook, for, in spite of the conditions named, the last three censuses show a slight but continuous increase in the total number of Indians. Nor is this increase among mixed-bloods alone; the full-blooded Indians are also increasing in numbers. This indicates that the race has reached and passed the lowest point of its decline, and is beginning slowly but surely to recuperate.

The Change to Reservation Life

The health situation on the reservations was undoubtedly even worse twenty years ago than it is to-day, but at that period little was heard and still less done about it. It is well known that the wild Indian had to undergo tremendous and abrupt changes in his mode of living. He suffered severely from an indoor and sedentary life, too much artificial heat, too much clothing, impure air, limited space, indigestible food—indigestible because he did not know how to prepare it, and in itself poor food for him. He was compelled often to eat diseased cattle, moldy flour, rancid bacon, with which he drank large quantities of strong coffee. In a word, he lived a squalid life, unclean and apathetic physically, mentally and spiritually.

This does not mean all Indians—a few, like the Navajoes, have retained their native vigor and independence—I refer to the typical "agency Indian" of the Northwest. He drove ten to sixty miles to the agency for food; every week end at some agencies, at others every two

weeks, and at still others once a month. This was all the real business he had to occupy him—travelling between cabin and agency ware-houses for twenty-five years! All this time he was brooding over the loss of his freedom, his country rich in game, and all the pleasures and satisfactions of wild life. Even the arid plains and wretched living left him he was not sure of, judging from past experience with a government that makes a solemn treaty guaranteeing him a certain territory "forever," and takes it away from him the next year if it appears that some of their own people want it, after all.

Like the Israelites in bondage, our own aborigines have felt the sweet life-giving air of freedom change to the burning heat of a desert as dreary as that of Egypt under Pharaoh. It was during this period of hopeless resignation, gloomily awaiting—what? no Indian could even guess—that his hardy, yet sensitive, organization gave way. Who can wonder at it? His home was a little, one-roomed log cabin, about twelve by twenty feet, mud-chinked, containing a box stove and a few sticks of furniture. The average cabin has a dirt floor and a dirt roof. They are apt to be overheated in winter, and the air is vitiated at all times, but especially at night, when there is no ventilation whatever. Families of four to ten persons lived, and many still live, in these huts. Fortunately the air of the plains is dry, or we should have lost them all!

Remember, these people were accustomed to the purest of air and water. The teepee was little more than a canopy to shelter them from the elements; it was pitched every few days upon new, clean ground. Clothing was loose and simple, and frequent air and sun baths, as well as baths of water and steam, together with the use of emollient oils, kept the skin in perfect condition. Their food was fresh and wholesome; largely wild meat and fish, with a variety of wild fruits, roots, and grain, and some cultivated ones. At first they could not eat the issue bacon, and on ration days one might see these strips of unwholesome-looking fat lying about on the ground where they had been thrown on the return trip. Flour, too, was often thrown away before the women had learned to make bread raised with cheap baking-powder and fried in grease. But the fresh meat they received was not enough to last until the next ration day. There was no end of bowel trouble when they were forced by starvation to swallow the bacon and ill-prepared bread. Water, too, was generally hauled from a distance with much labor, and stood about in open buckets or barrels for several days.

As their strength waned, they made more fire in the stove and sat over it, drinking rank coffee and tea that had boiled all day on the same stove. After perspiring thus for hours, many would go out into the bitter cold of a Dakota winter with little or no additional clothing, and bronchitis and pneumonia were the inevitable result. The uncured cases became chronic and led straight to tuberculosis in its various forms.

Furthermore, the Indian had not become in any sense immune to disease, and his ignorance placed no check upon contagion and infection. Even the simpler children's diseases, such as measles, were generally fatal. The death rate of children under five was terrific. I have known women to bear families of six or eight or ten children, and outlive them all, most dying in infancy. In their state of deep depression, disease had its golden opportunity, and there seemed to be no escape. What was there to save the race from annihilation within a few years? Nothing, save its heritage of a superb physique and a wonderful patience.

The Indian Service Physician

The doctors who were in the service in those days had an easy time of it. They scarcely ever went outside of the agency enclosure, and issued their pills and compounds after the most casual inquiry. As late as 1890, when the government sent me out as physician to ten thousand Ogallalla Sioux and Northern Cheyennes at Pine Ridge agency, I found my predecessor still practising his profession through a small hole in the wall between his office and the general assembly room of the Indians. One of the first things I did was to close that hole; and I allowed no man to diagnose his own trouble or choose his pills. I told him I preferred to do that myself; and I insisted upon thoroughly examining my patients. It was a revelation to them, but they soon appreciated the point, and the demand for my services doubled and trebled.

As no team was provided for my use to visit my patients on a reservation nearly a hundred miles square (or for any other agency doctor at that time), I bought a riding horse, saddle and saddle-bags, and was soon on the road almost day and night. A night ride of fifty to seventy-five miles was an ordinary occurrence; and even a Dakota blizzard made no difference, for I never refused to answer a call. Before many months I was supplied by the government with a covered buggy and two good horses.

I found it necessary to buy, partly with my own funds and partly with money contributed by generous friends, a supply of suitable remedies as well as a full set of surgical instruments. The drugs supplied by contractors to the Indian service were at that period often obsolete in kind, and either stale or of the poorest quality. Much of my labor was wasted, moreover, because of the impossibility of seeing that my directions were followed, and of securing proper nursing and attention. Major operations were generally out of the question on account of the lack of hospital facilities, as well as the prejudice of the people, though I did operate on several of the severely injured, after the massacre at Wounded Knee. In many cases, it was my task to supply my patients with suitable food and other necessaries, and my wife was

always prepared for a raid on her kitchen and store-room for bread, soup, sheets and bandages.

The old-time "medicine-man" was really better than the average white doctor in those days, for, although his treatment was largely suggestive, his herbs were harmless, and he did allay some distress which the other aggravated, because he used powerful drugs almost at random and did not attend to his cases intelligently. The native practitioners were at first suspicious of me as a dangerous rival, but we soon became good friends, and they sometimes came frankly to me for advice and even proposed to borrow some of my remedies.

Of course, even in that early period when the average government doctor feared to risk his life by going freely among the people (though there was no real danger unless he invited it), there were a few who were sincere and partially successful, especially some military surgeons.

Now that stage of the medical work among the Indians is past, and the agency doctor has no valid excuse for failing to perform his professional duty. It is true that he is poorly paid and too often overworked; but the equipment is better and there is intelligent supervision. At Pine Ridge, where I labored single-handed, there are now three physicians, with a hospital to aid them in their work. To-day there are two hundred physicians, with a head supervisor and a number of specialists, seventy nurses, and eighty field matrons in the Indian service.

Some Mistakes and the Remedies

Another serious mistake has been made in the poor sanitary equipment of Indian schools. Close confinement and long hours of work were for these children of the forest and plains unnatural and trying at best. Dormitories especially have been shamefully overcrowded, and undesirable pupils, by reason both of disease and bad morals, allowed to mingle freely with the healthy and innocent. Serious mishaps have occurred which have given some of these schools a bad name; but I really believe that greater care is being taken at the present time. It was chiefly at an early period of the Indian's advance toward civilization that both mismanagement and adverse circumstance, combined with his own inexperience and ignorance of the new ways, weakened his naturally splendid powers and paved the way for his present physical decline. His mental lethargy and want of ambition under the deadening reservation system has had much to do with the outcome.

He was in a sense muzzled. He was told: "You are yet a child. You can not teach your own children, nor judge of their education. They must not even use their mother tongue. I will do it all myself. I have got to make you over; meanwhile I will feed and clothe you. I will be your nurse and guardian."

This is what happened to this proud and self-respecting race! But since then they have silently studied the world's history and manners; they have wandered far and wide and observed life for themselves. They have thought much. The great change has come about; the work has been done, whether poorly or otherwise, and upon the whole the good will prevail. The pessimist may complain that nothing has come of all the effort made in behalf of the Indian. I say that it is not too late for the original American to regain and re-establish his former physical excellency. Why should he not? Much depends upon his own mental attitude, and this is becoming more normal as the race approaches, and some part of it attains to, self-support and full citizenship. As I have said, conditions are improving, yet much remains to be done, and it should be done quickly. An exhaustive inquiry into health conditions among the tribes was made in accordance with an act of Congress in 1912, and the report presented in January, 1913, was in brief as follows:

1. Trachoma is exceedingly prevalent among Indians.
2. Tuberculosis among Indians is greatly in excess of that estimated for the white population.
3. The sanitary conditions upon reservations are, on the whole, bad.
4. The primitive Indian requires instruction in personal hygiene and habits of living in stationary dwellings.
5. The sanitary conditions in most Indian schools are unsatisfactory.
6. There is danger of the spread of tuberculosis and trachoma from the Indian to other races.
7. Due care is not taken in the collection and preservation of vital statistics.
8. The medical department of the Indian Bureau is hampered by insufficient authority and inadequate compensation.

As a result of this and other investigations, increased appropriations have been asked for, and to a limited extent provided, for the purpose of preventing and treating disease, and especially of checking the spread of serious contagious ailments. More stress is being laid upon sanitary precautions and hygienic instruction in Indian schools, and an effort is made to carry this instruction into the Indian home, through field matrons and others. Four sanitoria or sanitarium schools have been successfully established in suitable climates, and it is recommended by an Indian Service specialist that certain boarding-school plants be set apart for trachoma pupils, where they can have thorough and consistent treatment and remain until the cure is complete. Much larger appropriations are needed in order to carry out in full these beneficent measures, and I earnestly hope that they may be forthcoming.

It is interesting to note that whereas a few years ago the Indians were reproved for placing their sick in canvas tents and arbors, and in every way discouraged from any attempt to get out of their stifling

houses into the life-giving air, sleeping-porches are now being added to their hospitals, and open-air schools and sanatoria established for their children. The world really does move, and to some extent it seems to be moving round to the red man's original point of view. It is not too late to save his physique, as well as his unique philosophy, especially at this moment, when the spirit of the age has recognized the better part of his scheme of life.

It is too late, however, to save his color; for the Indian young men themselves have entirely abandoned their old purpose to keep aloof from the racial melting-pot. They now intermarry extensively with Americans and are rearing a healthy and promising class of children. The tendency of the mixed-bloods is toward increased fertility and beauty as well as good mentality. This cultivation and infusion of new blood has relieved and revived the depressed spirit of the first American to a noticeable degree, and his health problem will be successfully met if those who are entrusted with it will do their duty!

My people have a heritage that can be depended upon, and the two races at last in some degree understand one another. This is his native country, and its affairs are vitally his affairs, while his well-being is equally vital to his white neighbors and fellow-Americans. I have no serious concern about the new Indian, for he has now reached a point where he is bound to be recognized.

WHAT ANIMAL EXPERIMENTATION HAS DONE FOR CHILDREN

By HENRY DWIGHT CHAPIN, M.D.

NEW YORK

THE rich contribution that animal experimentation has yielded to the direct, curative treatment of disease is well known to all educated physicians. The lay public, however, seem to be insufficiently informed as to the many benefits that have been derived from this method of scientific investigation. If so, they would give little heed to the false statements and hysterical imaginings that are periodically given out by small but vociferous opponents of this beneficent work. If the public once clearly understands that helpless, suffering children will be the class to suffer most, a positive and instant check will be administered to those who aim to stop the most fruitful advance in scientific medicine. At present, a few ill-balanced people seem to derive a cheap and easy glow of self-satisfied altruism by exaggerating the discomforts of animals who are being studied for the good of the human race.

The object of this paper is to show what animal experimentation has actually done for children. Let us substitute real facts for morbid and exaggerated fancies. Let us weigh the relative importance of a child's suffering or life against the discomfort and even occasional suffering of a dog. This is directly pertinent, for, in a last analysis, the defenceless child will have to pay the principal penalty if the advances in treatment brought about by animal experimentation are to be retarded or checked. A large part of all sickness occurs among children. The period of growth is one of great physiological energy, and pathological changes are often only an index of an overstrained physiological activity. Besides this, young protoplasm is irritable and favors the development of germs of all kinds. The victims of microbic diseases are chiefly the young. It is evident that the complete understanding and treatment of disease at this period assume the greatest importance, and anything interfering with such beneficent work may have the gravest consequences. It thus becomes a question of morals as well as medicine.

A brief review of some of its brilliant accomplishments will serve to emphasize the value of animal experimentation for children:

DIPHTHERIA

The most overwhelming proof of the value of a specific treatment is seen in connection with antitoxin in diphtheria. Before the intro-

duction and use of antitoxin in 1895, diphtheria could truthfully be called one of the greatest scourges of childhood. The death rate began to fall all over the civilized world with its increasing employment.

The following table, quoted from Keen, gives the official reports of the mortality from diphtheria for every 100,000 inhabitants in certain American and European cities before the use of antitoxin and after its employment had become general:

TABLE OF MORTALITY FROM DIPHTHERIA

	Per 100,000 Inhabitants	
	1894	1905
New York (Manhattan)	158	38
Philadelphia	128	32
Baltimore	50	20
Boston	180	22
Brooklyn	173	43
Pittsburgh	64	26
London	66	12.2
Paris	40	6
Vienna	114	19

Later on, Dr. Park in a study of the average death rate from diphtheria in 19 large cities of the world in 1893 shows it to have been slightly over 80 per 100,000; in 1895, when the antitoxin treatment was introduced it began to fall, and by 1907, when antitoxin was generally employed, the rate had dropped to 17 per 100,000.

In the London hospitals the mortality has been reduced from 29 per cent. to about 10 per cent. The same is true of other large hospitals of the world.

These studies extending over widely diverse localities and long periods of time do away with such possible errors as varying severities of epidemics or chance local conditions.

Not only has the death rate been much lowered, but the severity of the disease and its complications have been marvellously changed for the better. Perhaps this is best seen in the great diminution of the fatal and agonizing croup cases, where the false membrane descends into the windpipe and causes death by slow strangulation. We wish those who are trying to throttle scientific research would witness the awful struggle of a child dying from diphtheritic croup. Fortunately even physicians are now seldom forced to go through such an ordeal, owing to the beneficent results of a treatment directly inaugurated as a result of animal research. At the Willard Parker Hospital, even the late and neglected cases of croup that have not had the remedy before admission, after a large, though belated dose of antitoxin now very rarely die from strangulation. If they succumb to other complications, they are at least mercifully spared the torture of prolonged strangling. Before anti-

toxin days, two thirds of the croup cases that were tubed died at this hospital; now three quarters are saved. It is hard to realize what such figures actually mean. In the years preceding the discovery of the germ that causes diphtheria and the working out of its antidote, among the cases reported as dying from diphtheria, more than 75 per cent. were attributed to diphtheria of the windpipe.

Antitoxin, when early and properly given, will not only cure in a majority of cases but likewise immunize those closely exposed to the infection of the disease. Over 35,000 cases were thus treated by the New York Board of Health without any serious sequel.

Cerebro-Spinal Meningitis

One of the most fatal and distressing diseases, confined largely to children, is epidemic and sporadic cerebro-spinal meningitis. Before the working out of the anti-meningitis serum by careful, scientific experimentation on animals, there was no method of preventing the growth, and appalling effects of the meningococci that caused the disease. Now we have a serum that not only directly destroys or inhibits the growth of the germs, but also indirectly acts by stimulating the white blood cells to overcome the germs. At the same time a neutralizing action is exerted on the soluble and diffusible poisons that are secreted by the deadly meningococci. As a result, not only has the mortality been greatly lowered, but the severe symptoms and crippling complications have been most favorably influenced. The lowest mortality before the serum treatment ran from about 50 per cent. in sporadic cases to 75 per cent. in the epidemic form in different parts of the world. When the serum is now given by spinal puncture, the mortality drops to about 25 per cent. or even lower. If the serum is given early in the disease, the altered mortality is still more remarkable. The following table quoted by Dunn from the studies of Dopter shows this feature:

Mortality in Epidemic Meningitis under Serum Treatment

Cases Analyzed According to Period of Injection

	Flexner, Per Cent.	Netter, Per Cent.	Dopter, Per Cent.
First to third day	14.9	7.14	8.2
Fourth to seventh day	22.0	11.1	14.4
Later than seventh day	36.4	23.5	24.1

In cases that recover, the serum treatment not only shortens the duration of the disease—sometimes by several weeks—but lessens the chances of the terribly destructive sequelae, such as hydrocephalus, blindness and deafness.

Tuberculosis

While tuberculosis is a disease of all ages, its ravages are peculiar and widespread at the beginning of life. Children contribute their fair share of the awful record of one seventh of all the deaths in the world. Certain peculiarities of tuberculous manifestations in early life, such as the special involvement of lymph glands, bones, joints and peritoneum, rather than a limitation to the lung, have made the disease an interesting and hopeful study at this time. In order to successfully treat the condition, early recognition, before much destruction of tissue has taken place, is imperative. Early diagnosis, by means of inoculation, means a successful cure in a large proportion of cases. Hump-backed children, from tuberculosis of the spine, and permanent lameness from hip-joint disease, are rapidly becoming misfortunes of the past. Not only the way in which tubercle bacilli act in various tissues, but the methods of their transmission, are now known, thanks to animal experimentation. The knowledge of its spread by meat and milk has led to careful inspection of carcasses and an improvement and cleaning up of the milk supply in large areas of country by commissions and municipalities. The whole tuberculosis crusade, in which children are so largely the beneficiaries, would have been impossible without the use of rabbits and guinea pigs. The communicability of tuberculosis has thus been proven and efficient steps taken to prevent its spread. The treatment by abundant fresh air, sunlight and forced nutrition has naturally followed a better understanding of the disease. Seaside and mountain sanitoria, that are now so successfully treating the various forms of bone and gland tuberculosis in children, are but the end products of demonstrations that started in animal experimentation. Trudeau with his series of inoculated rabbits, keeping some in the open air with full nourishment that recovered, while those that were confined and underfed died, started the ideas that have had such fruitful results. In a period of twenty years, the death rate from tuberculosis in New York was reduced approximately forty per cent., and in Boston fifty-five per cent. This means the escape of hundreds of children from death or permanent disability.

Finally, a most hopeful result of animal study has shown that tuberculosis is not inherited. Thus has been removed the hopelessness that went with such a belief as regards the child. A knowledge that this dreaded disease is usually preventable and often curable acts as a stimulus to renewed and successful efforts for its final elimination.

Cretinism

The scant relief possible for most forms of idiocy is well known to both physicians and teachers. In recent years one kind of mental de-

fect has been explained and largely cured by a knowledge of the internal secretion of the thyroid gland. Formerly these cases were doomed to remain semi-imbeciles. They were repulsive in appearance, with stunted growth, facial blankness, tongue protruding from half-open mouth, trunk large with pendulous abdomen and short stumpy limbs. A dull, apathetic mentality was always in evidence. An implantation of the thryoid in the abdominal cavity of dogs by Schiff showed that this gland would functionate even after its removal or absence from its normal location. From this it was but a step to demonstrate that by administering an extract of the thyroid gland by the mouth, the symptoms due to its abnormal absence in the child would be removed. The arrested, perverted growth and mental dulness due directly to the absence of this important internal secretion can thus be easily corrected by giving the dry extract from the thyroid of an animal. A whole class of hopeless defectives has thus been rehabilitated.

Hydrophobia

This fearful disease, produced by the bite of a rabid animal, is one to which children are peculiarly disposed on account of their close association with domestic animals and their lack of judgment in failing to recognize sickness or distemper among them. Just here can well be shown the disastrous results of some of the efforts of those peculiar people who suffer from "Zoophil psychosis." According to Frothingham there were but 38 rabid dogs in England in 1892, but at this time the authorities removed the "cruel muzzle" owing to an agitation by the "dog lovers." As a result, during the next five years 1,602 dogs, as well as many other animals, and 51 human beings died from this agonizing disease. Even if proper means of prevention are not enforced and individuals are bitten by rabid animals, the mortality can now be very largely reduced. The Pasteur treatment has already lowered the death rate from between 6 per cent. and 14 per cent. to well under 1 per cent. This is true all over the world. Even the dogs, as well as children and adults, have profited by Pasteur's efforts at stamping out hydrophobia.

Vaccination

The prevention and change in the severity of small-pox by vaccination have been of largest benefit to children, as this loathesome disease is especially fatal and disfiguring at this time. Of 3,164 deaths in the great Montreal epidemic, 85 per cent. were in children under ten years. When vaccination is performed in infancy, the disease is prevented during the period of growth or so altered as to be innocuous. Early vaccination has completely changed the character and age period of small-pox: it was formerly so essentially a child's disease as to be called

"child pox." Rotch reports that during fifteen years no deaths from smallpox occurred in Boston in children who had been vaccinated under five years of age, while during the same time the mortality in the unvaccinated was 75 per cent. Similar conditions have been noted in other centers. It is hard to realize what overwhelming calamities were once caused by this fearful disease. Smallpox has now been practically stamped out in civilized countries by vaccination, yet it has been estimated that 60,000,000 died from this loathsome affection in Europe during the eighteenth century, and multitudes who did not die were permanently scarred and mutilated. The reign of destruction and death accompanying this disease continued until Jenner's great discovery in 1796. In Germany, where a compulsory vaccination and revaccination law has been enforced, there has not been an epidemic of small-pox for thirty-five years, although adjacent countries, not so protected, have had numbers of epidemics.

In the present discussion, it is interesting to note that a lower death rate from small-pox has been largely confined to children as they are so generally vaccinated. After the first decade, the protection is apt to wane and revaccination is required for full safety. The last objection to vaccination—the possible induction of other diseases—has now been completely removed by experiments on calves which shows that smallpox virus may be converted into a protective but innocuous vaccine virus by being transmitted through several bovine generations. Calf vaccination thus provides an adequate amount of virus that is safe because produced under careful scientific oversight of an animal fully protected from any disease or outside contamination.

While in the above-mentioned diseases the preponderating benefits in treatment have accrued to children, there are others in which the child shares with the adult in the advances derived from animal experimentation.

Malaria

Malaria, to which children are very susceptible, has been made largely a preventable disease by a study of the mosquito carrier, its breeding places and natural history, and by inoculation experiments on animals and man. It was proven by Italian observers that the mosquito disseminates bird malaria in the same manner as in the human subject. The final upshot of these investigations has been that large tracts of hitherto waste and dangerous land have been rendered safe and productive. A widespread cause of debilitating sickness, and even of death, has thus been removed. In such areas, the saddest sight has been the stunted, anemic children, with enlarged livers and spleens, the evidences of chronic malarial poisoning that can now be obviated by putting modern knowledge into effect.

The benefits of vaccination against typhoid fever are shared by children with adults, and the tests for the speedy recognition of tuberculosis and syphilis have given brilliant results by allowing early and successful treatment. It has been ignorantly or maliciously stated that these diseases may be induced by these tests, whereas such an accident is rendered impossible by the preliminary destruction of the living virus. Most of these charges are made by those having a ludicrous ignorance of the most elementary facts of biology.

In many cases, the destructive and prolonged poisoning of syphilis can be eradicated by a few doses of Salvarsan followed by the older alterative treatment, and thereby a hereditary taint completely removed. It is thus possible to protect innocent mothers and unborn or recently born infants.

Surgical Conditions

It is hardly necessary to state that children have derived their full share in the inestimable benefits that have followed aseptic and antiseptic surgery. Septicemia and pyemia are prevented and frequently cured. Cavities of the body formerly out of reach of surgical aid are now fearlessly explored and life thus saved. As an example, the various obstructions of the bowel peculiar to children are cured in a large proportions of cases. In former times death usually ensued in such conditions, as both physician and surgeon feared the large mortality that followed the opening of the abdomen. Even very young infants are now successfully operated upon for this grave condition. Certain forms of peritonitis are cured by simply opening the abdomen.

Recently, bone grafting, that promises brilliant results in straightening crooked backs and other bony deformities in children, has been successfully tried as a result of previous experiments on animals.

Profuse and uncontrollable hemorrhages in the newly-born, formerly fatal, are now saved by transfusion, which was first studied and the technique perfected by vessel suturing in the lower animals. Practically the whole realm of surgical accidents and diseases in children has been benefited and illuminated, directly and indirectly, as a result of animal experimentation. We must not forget to mention, in this connection, how anti-tetanus serum has prevented lockjaw after certain jagged wounds. It has thus helped to take away some of the horror from the frequent accidents to children in the cherished, but undesirable, Fourth of July celebrations.

If such great and beneficent work has already been accomplished in a few years, it is safe to prophesy more certain and brilliant results in the future. Scientific men have perfected their knowledge and technique and are fast conquering nature's secrets. There is no foretelling to what extent disease can be overcome by persisting in the present fruitful

methods. Already infantile paralysis is being hopefully studied as to cause and consequent cure. The same can be said of other crippling and fatal diseases.

The lay public must be taught to appreciate and encourage the devoted men who are patiently toiling in laboratory and clinic, frequently at the risk of their own health or life, to discover the secrets of disease and thereby conserve both health and life in others. They are the true apostles of the modern world. Our civilization owes them a debt of gratitude that can never be paid. If they are to be harried and obstructed in their fruitful work, it will be at the risk of ending all scientific advance. Any community with such narrow vision as to allow such obstruction will stand convicted by the judgment of an enlightened humanity.

EUROPE'S DYNASTIC SLAUGHTER HOUSE

By WILLIAM J. ROE

THUS, half a century ago, he forecasted what is now happening on the other side of the Atlantic, who was perhaps America's most subtle reasoner. He is commonly classed as a poet—this man, Walt Whitman—lauded as such, reviled as such. He was really a prophet; though, as it is presumed to be well known, "High Criticism" in final analysis declares that the words prophet and poet are synonyms.

The younger Scipio Africanus has left an account of his observations of a great battlefield; of the battle fought between Syfax and Hasdrubal, the Carthaginian, and Massinissa, an ally of Rome. Scipio chanced to be present in Africa when this battle was fought, and was able to witness every manoeuvre from a height near the field of conflict. From the account thus transmitted to modern times has come the adage that "Onlookers see most of the game."

Manifestly, however, Scipio's observations would have served little if he had been a common peasant or mere civilian. He was able to comprehend the tactical movements and their relations to the strategy of the contending forces solely because his military training enabled him to understand the meaning of isolated movements and their bearing upon the final result.

While strategic principles remain to-day in precisely the same condition that they were at the beginning of the last Punic war, it is of course no longer possible for a neutral observer to station himself upon a height and overlook a battlefield. The numbers engaged are too great, the field far too vast, the range of projectiles too extended, the obscurity of the "battle cloud" too dense. For data of military events the reporter, critic and interpreter is compelled to rely upon reports, official or otherwise, and these always more or less romantic, or actually mendacious, and usually garbled, censored out of all correct perspective in the endeavor to deceive both friend and foe, to meet supposed military or political expediencies.

The scope of the observer of military operations at the present day has not only been immensely broadened, but wholly altered in character. The critic of strategical combinations and tactical movements must now be equipped with information undreamed of in the days of the Romans and Carthaginians, dreamed of doubtless, but as yet subsisting only in dreams during the Napoleonic wars, and which for virtually the first

Area of murder-plots of thrones, with scent left yet of wars and scaffolds everywhere.

time in the long record of man's inhuman struggle with his fellow man, has become vitally essential.

To carry out the figure, the modern Scipio, viewing from a height in America the great war now waging in Europe (at present localized along the lines of the Aisne and Vistula) must be "expert" in a multitude of branches of knowledge, if he wishes to know accurately, either for his own satisfaction, or the worthier object of conveying information to others, with a view possibly to mitigating some existing horrors, or to avert needless calamities. Such an observer must possess a fairly complete theoretical knowledge of the science and art of war. He must be informed as to topographic conditions, not only at the immediate scene of combat, but in all directions wherever new lines of offense or defense could be established. He must know thoroughly conditions of transportation, provisioning, armaments, offensive and defensive, powers, ranges, etc., of ordnance and small arms of combatants, and not only available present supplies, but resources, near and remote, of every possible kind. And his knowledge must take into account in this day of novelty everywhere of sea-forces and air-forces, an approximation at least to familiarity with all recent devices of mines, torpedoes, submarines, etc., and a sufficient working knowledge of all varieties of war-craft and scout-craft of the air.

But besides all these informing utensils of elementary "militarism," the onlooker must have an intimate acquaintance with the general trend of history, not only of warfare, but of social, financial and political conditions, and besides he must be able to pick out unerringly the true meaning of those past events (like points on an orbit to the astronomer) which have gone to the influencing of those of to-day. But above all else this onlooker's acquaintance with the basic actuating and initiating function (commonly called "common sense") of human nature must be impregnable. This is in fact the chief ingredient in the puddler's flux, which (while individual actions elude all attempts at prophecy) give value to reasoning, and may be safely reckoned upon to provide trustworthy data for foreknowledge.

Viewing then the vast field of conflict now raging in Europe it is evident that bases for ascertaining the inevitable final resultant must be sought—not in any temporary incidents or conditions, nor from segmental logic, however well founded, but upon the data practically axiomatic—components equivalent in force and value to those of Euclid.

The inventor and constructor of a machine, which he is confident is entirely capable of performing its work—gratifying the vanity of the projector, adding to or making his fortune—is always restless, uneasy and dissatisfied until he has tested that machine in action.

This axiom of human nature applies to any machine whatever, es-

pecially to a novelty, and includes the vast, complicated, and diversely constituted mechanism of "blood and iron" which goes to the making of a standing army. The military system of the German empire was such a machine. The opportunity came to test its efficient action (fortune adding or making, or merely defending, it is all one) and immediately the opportunity was availed of. Germany was prepared to mobolize and she did mobolize, admirably and with wonderful celerity. She was prepared to attack, and doubtless with no thought, or but trifling thought of failure or even serious impending, she did attack. Owing to the rather unexpected and stubborn resistance of Belgium, and the entirely unexpected and most masterly strategy, credited, and it is probably correctly so, to General Joffre, the dynamics of offense—the sudden and overwhelming crushing of France—failed. The static energy still remains, as yet unimpaired, capable perhaps, though that is unlikely, of further offensive movement on a large scale.

What has been said of Germany's utilization of her wonderful war organization must not be taken as solely applying to the German empire. Certainly to debit the Kaiser, or the "ruling military class" or the mass of the Germanic peoples with a deliberate desire to incite war, is to assume an intention of murder-plotting which did not exist. France, as well as Germany, possessed a highly organized and (as has been amply proved in the field) effective military machine, which she would have employed with equal readiness aggressively, but for the ever-present doubt as to whether it would work in practise. France sighed as she thought of the alienated provinces, contemplated the preponderance of power of the neighbor who had filched them, exorting the billion of loot, sighed, shook her head with a doleful, *C'est trop dur,* and was at least partially consoled by the reflection, not that she felt herself more moral than Germany, but that "the inevitable was not debatable."

We come now to a candid, impartial, and unprejudiced consideration of another and quite different phase of the continental conflict.

Rivals in any line of activity are never very scrupulous as to utilizing—or sometimes even creating—opportunities to cripple, or even to destroy each other. This is especially cognizable in business affairs (from corner-groceries to empires). But a rival, however unscrupulous, feels in these modern days when public opinion is a force, a compulsion (called by some "moral") to defer to that force. It is incumbent upon him to find a pretext, real if possible, certainly plausible, for his crippling or destruction.

Russia, for the chances of an open Bosphorus and a permanent-ice-free port welcomed the challenge to arms, not with very great alacrity, but still it was welcome. France, because of possibilities that the future might disclose of reclaiming the lost provinces of Alsace-Lorraine,

was not unwilling to accept the challenge. And this challenge that Russia welcomed and France accepted not unwillingly, was responded to at once by Great Britain, cordially and greedily. For many years Germany had been insidiously encroaching upon Britain's supremacy in commerce—making and selling more available goods, and more and more displacing her rival in the markets of the world. To cripple or to destroy German commercial rivalry was desirable.

Of this desire, however strong it may have been, not a hint is to be found in any official paper or utterance. On the contrary, the so-called "white papers" and those of other colors, disclose an endeavor, even most strenuous effort, to avert war, and that only the high ethical ground of upholding the validity and obligation of treaties, and especially the integrity of the guaranteed neutrality of Belgium, precipitated war. These endeavors and efforts prove either the pacific incentives of individuals of the British foreign office, or the marvels of adroitness of publicists in power seeking to clothe a pretext in a garb of immaculate plausibility, probably both.

One of the wise fables of Æsop relates that a hound, reproached that his quarry, the hare, had outstripped him, replied that it was "one thing to be running for your dinner, and another for your life." The idea embodied in this fable may have had some place in bringing on the present war; it certainly has the very first place when questions are raised concerning the return of peace and the conditions of peace.

As to affixing "scientifically" (that is with knowledge) the responsibility for the terrible conditions prevailing, the factors are far too numerous and complex. The claim of the Allies of having had war thrust upon them is well taken; it was thrust upon them. The claim of Germany that she was forced to assume the "offensive-defensive"—that she fights for self preservation—is also well taken. On the surface, the seeds of war were sown when M. Berchtold, in the name of Austro-Hungarian dignity, exasperated beyond endurance by murder-plots in Servia, culminating in the assassination of Prince Ferdinand in Bosnia, in the attempt to exact a righteous reparation, overstepped a legitimate right of sovereignty. However guilty—or however much a conniver at guilt—Servia's moral right to resist an assault upon her independence can not be questioned. She went far enough in way of concession.

Several problems now present themselves which perhaps the future may solve, chief among which is found this: Would Austria have taken so strong a ground without definite assurance of support from the north? Whatever solution to this may finally be uncovered, and to other problems of like order, the certainty of responsibility goes further back, being found in a gross departure from the righteousness that should exalt a nation. By this is meant that the holding of Bosnia and the Slavic peoples wherever they dwelt under Austrian rule was wrong—

worse than wrong, it was folly. Imagine the clear-headed wisdom, which is of itself grandeur, that in the settlement of Balkan frontiers, with willingness and cordiality had furthered the cause of Servian nationality, not "grudgingly or of necessity" declined territorial aggression, and permitted—nay, invited Servia to a sea-port on the Adriatic.

Such highmindedness was not to have been expected of ruthless nationalism, as yet feudal, medieval, neither civilized nor Christian. What really happened was the outcome of age-old precedent, exponent of piracy and brigandage, that "they should take who have the power, and they shall keep who can." Such an action would (who for an instant doubts it?) have averted the war. Idealistic? Yes. Sentimental? Yes. But it would have been something else, something better by far than idealism or sentiment—it would have been clever—what we rude Yankees call "smart." In general it may be said that it is better to be clever than to be good, for cleverness includes morality; but "though thou shouldst bray a fool in a mortar yet will not his foolishness depart from him." There are all kinds of fools, but none so foolish as the fool who is sure of wisdom founded upon power, and not "broad-based upon the peoples' will."

Returning to the subject of a correct forecast of the future, undoubtedly neither Russia nor France has at stake very much more than losses—land, money and prestige. Though the ultimate success of German arms should be complete, neither Russia nor France need fear any spoiliation that time and economy can not retrieve from the most ruthless enforcement of the right of conquest. Of course France would again have heavy damage exacted; but Germany would be willing enough to "cry quits" with her gigantic Slavic neighbor. Both nations are (to use the apt simile of Æsop) "running for their dinner" and no more. Permanently to annex further French provinces would merely embarrass Germany, and already she has enough discontented and hostile Slavs without adding to their number.

But between Germany and Great Britain the relations—present and prospective—are and will remain until a final settlement, vastly different. These nations are both fighting "for their lives." With them it is war *à l'outrance,* to end only in the destruction or humiliation of one. As to which one this must inevitably be it needs hardly any "gift of prophecy" to forecast.

In considering the path and progress towards the inevitable, factors numerous, complex, and perplexing, crowd and jostle one another demanding recognition as important or conclusive. Current journalism is full of them, some occasionally suggestive, but mostly merely silly, being generally based upon partial, imperfect, or erroneous information, or upon prejudiced optimism. Just a few among many having real

relevancy, may be casually mentioned. The German war-ships, self-interned at the Kiel canal, may at any time prove a very active menace; much more probably than those Zeppelins, the very talk concerning which has thrown a chill to the heart of England. It was premature; the big Zeppelins are very vulnerable, rightly assailed, and—happily for English comfort—they realize it.

On the other side there lies the inviting coast of the former Danish province of Schleswig. Behind the Sylt the waters are shallow, but it would not be difficult to land an army there. In time something similar may be reckoned upon—a force, probably all British, with suitable ordnance, to advance upon the canal and its fortifications on the north, to demolish these at leisure, and afterwards try conclusions with the fleet, unless it had slipped out, warily into the Baltic or boldly into the North sea. This project of invasion is instanced, not as imminent, but rather a strong possibility of the future. Its efficacy is found in facilitating operations, in affording a third "face" of attack.

In considering the outcome the element of time is of course a very uncertain quantity. But time is an ally of the Allies, the most stanch, most certain and trustworthy ally. All told, Germany can perhaps count upon about one hundred millions actually or nominally loyal to her cause. Russia, Britain, and France combined can count upon at least six hundred million, with equal or greater confidence of loyalty. Germany is badly handicapped. The greater general intelligence of her population; its greater diffusion of freedom of thought; these in time will begin to ask questions, to urge demands.

During our civil war, a rude mountaineer was brought into camp as a prisoner somewhere in east Tennessee. At first surly, at last he softened. "Say!" said he to his guard, "what anyway is you-uns fightin' we-uns for?" If ignorance could be brought to put so admirable an enquiry, how much more likely—at the right time—the "psychological time," will intelligence!

Day after day, slowly the equality between opposing forces will be diminished, replaced by increments of preponderance of the Allies. The effective strength of numbers will slowly crumble on one side, slowly accumulate for power of offense on the other. The very successes of German arms point the way to her ultimate downfall. The day of the facile fall of the Vauban-planned fortifications of Antwerp, added to by every device of science and steel, was a great one for the cause of universal peace, far greater than anything effected by the Hague Tribunal, or by all the peace treaties ever signed. The meaning is—or ought to be—evident—that the day of armored defenses *as defenses* against the ponderous ordnance constructed by the Krupps is at an end. Even at this hour there are several object lessons to invite scrutiny, notably that Verdun continues impregnable, not because of its being invulnerable as

a bastioned work of the first class, but that the French burrowing in the ground are holding off the enemy to so great a distance that effective batteries can not be planted.

For many months the question of food supplies will not be pressing for the Germans. But in time this will bear its part in the final catastrophe, by adding to the distress that is certain to come. In times of peace the empire is almost—but not quite—self supporting. With war on both—or all—borders forbidding any considerable importation of provisions, the deficit greatly augmented by war's inevitable waste, will result in scarcity, eventually in localized deprivation or even a degree of actual famine.

How the end will come, or when it will come, is beyond all human foresight, or possibility of even approximate prediction. That it will come is certain. When at last—in a year, two years, or after many years, after incidents perhaps of horror beyond scrutiny or imagination —when Germany lies prostrate and defenseless, what then will happen?

Europe was once before similarly afflicted, similarly desolated. From first to last the history of the Parisian revolt against the excesses of the Bourbons, striking—as revolution often does—at the least excessive of them all, is before us. We know the rise of the plebeian, Bonaparte; his good work for French liberty; his misplaced advancement of French "glory," his futile "militarism," finally crushed by counter-militarism vaster in numbers. After Waterloo (or *La Belle Alliance*) the victorious allies of 1814 dictated at Paris terms that restored a system not a whit an improvement upon the past of Louis XVI., but which yet was compelled to accept or adopt improvements. Even with Napoleon at St. Helena, his work—because it advanced the cause of human freedom —lived and grew; it had life abiding in it.

This portentous precedent, with many others more remote, are before us. Guided by them alone it would not be difficult to approximate to the onerous and degrading terms which it has been the invariable habit of victory to impose—enormous money compensation, extending to virtual impoverishment, even the enforced elimination of the Hohenzollerns and the total dismemberment of the empire. That indemnities will be exacted in huge amounts, mortgaging the prosperity of the Germanic people for many decades, even generations, is hardly doubtful. The provinces of Alsace and Lorraine will naturally be restored, Russia will probably acquire whatever additional Slavic territory may seem to her desirable; and Belgium be recompensed for her loyalty and losses by donations of Luxemburg and of sufficient of Rhenish Prussia most amply to compensate her. That Schleswig and Holstein, filched from Denmark in 1864, may be restored is highly probable, of course under rigid guarantees of international usage of the Kiel canal. Italy's position is easier to define than her prospects to risk prophesying; to-day neutral

(because to fulfill her obligation of the "Triple Alliance" was too dangerous), to-morrow perhaps openly antagonistic to Germany (because satisfied that thus only can she share in the spoil), those sections of country known as Italy Unredeemed may become hers.

The Austro-Hungarian empire will suffer nationally even more than the states constituting the empire of Germany; but probably to the decided betterment of the several races. It is of course not impossible that partition of the monarchy may be averted by a separate peace, though Austria can hardly expect to retain intact her heterogeneous segments. The Balkan peninsula will again be remapped, and (provision being made for canalization of the Bosphorus and Dardanelles) Moslem rule at and near Constantinople will be replaced by a "zone" that self interest will respect, power cause to be respected, and a new and more equitable "balance" established in measurably stable equilibrium.

At the present time (mid-December, 1914) while the contending forces are locked in a life or death grapple on the west, and are swaying to and fro, now one having advantage, then another on the east, there are many good people, well-meaning people, appalled at the losses of life and waste of substance, who would seek to end the hideous horror by urging immediate pacification.

But to end the war now, even if it were possible, would be most deplorable. Doubtless to seem to advocate a continuance of bloodshed and destruction must to these people—"peace-at-any-price" people—appear wantonly cruel. Scanning the course of human progress, it is clearly to discern from remotest epochs incidents (lights shining in the darkness uncomprehended by the darkness) tending to ameliorate the unhappy conditions of the masses of men. It is not this generation alone, its sentiments and ideals, but all coming generations whose welfare and happiness it should be for men of to-day—actors and thinkers alike—to toil for and to plan for.

There is a current phrase, prated of for the most part ignorantly—"getting back to nature." Rightly understood the idea is admirable. But in final analysis, nature is indifferent, implacable, impartial, and so cruel. Nature cares nothing for individual lives, everything for life; nothing for men, all for man; nothing for artificial nations, all for races and for peoples.

Action and thought should emulate nature. In the terrific emergency now thrust upon the world, nothing should restrain us—no consideration of expediency, or even of temporary humanity—from holding fast and upholding firmly the ways and means that tend to the destruction of destruction, to establishing new and sure and safe guarantees. Fortifications of stone were found to be of no avail against the bombardment of the Columbiads and the Armstrongs and the Whitworths; re-

placed by bastions and scarps and turrets of steel, these also before the fire of colossal ordnance crumpled like parchment. In any new settlement or alignment shall nations be invited, encouraged or permitted once again to enter upon a ghastly rivalry of forces, to construct again so called defenses incalculably stronger, but destined in some future war to annihilation? Such a settlement is unthinkable; peace established at a prospect of cost to our coming race would indeed be cruelty.

Let us renew the query: when Germany lies prostrate and defenseless, what will happen? And let us add—not sentimentally or morally, but practically, and "scientifically"—what ought to happen? To many Americans, probably to a majority even of those not ill informed as to matters of negotiation in the early days of our national existence, it appeared singular that Great Britain consented with so little show of reluctance (it was in fact with suppressed alacrity) to modify so seriously the old Clayton-Bulwer treaty, by which modification we gained a very practical control of the interoceanic waterway. In few words it was because Britain's far-sighted diplomacy easily recognized in the United States a prospect of profitable alliance, unwritten and un-"entangling" though it were, by which the mistress of the seas shifted upon America (on account of our "Monroe doctrine") the expensive and disagreeable duty of policing the Western Hemisphere. With quiet and well-founded confidence immediately after the ratification of this treaty, Great Britain withdrew her war ships from American waters. The value of this treaty—this "scrap of paper,"—lay not at all in any especial reliance by Great Britain upon American national righteousness or friendliness, but upon that which in every exigency of human affairs, with nations and individuals alike, is more trustworthy than all professions of friendship, than all righteousness—enlightened self interest, mutual benefit.

Much has been written, and with very great ability and high sense of the obligation of "ethical values," concerning the establishment hereafter of an international "posse comitatus," to the end of enforcing peaceful relations, and of compelling acquiescence in the decrees of an international court of arbitration. The weakness of such an arrangement—most admirable if it could be assured in perpetuity—lies in this: that its permanence would depend not solely upon mutuality, but largely upon comity, upon a "scrap of paper," a contract voidable at any moment by one or the other of the "high contracting powers."

It is a military axiom that "one bad general is better than a dozen good ones," and an axiom of very practical business that for utility and prompt acceptance a novel invention must "utilize already existing plants." These two sayings, axiomatic or merely aphoristic, as one chooses to regard them, may find unexpected, but very practical application in the future, near or remote. It is by no means impossible that

in the inevitable new alignment of European influence and power, a doctrine of Great British diplomacy may arise akin to that so notorious as of Monroe. It would mean a policy of "policing" applied to the eastern continent, and its similarity to our own benevolent protectorate would be pronounced, since very recently the United States has been joined by the strong and self-sustaining republics of South America, Brazil, Chile, and the Argentine. In effect we have become merely *primus inter pares* on this side of the Atlantic, and that would be the position of Britain upon the other.

Because of her vastly preponderant sea-power Great Britain would be able to enforce virtually whatever police authority she desired to assume. Her assumption of permanent leadership, certain to be resented and opposed if by a premature and unnatural patching up of amicable relations, the old antagonistic order were resumed, would be concurred in, not only by the partners of the present alliance, but by the feebler nations, who would further it cordially, for economy, for safety, for practicability; but only in the event of the establishment of a new order founded upon an enduring equity.

How then will it be possible and practicable to ensure equity? Eventually upon Great Britain alone will rest the supreme responsibility. In conjunction with her allies the rights, obligations, and privileges of nations and races will be readjusted on the European continent; but her interest extends, and her power for good or evil, throughout the world. In the past (as history amply testifies) British greed has seldom been thwarted very seriously by British sentiment. Either by conquest or artifice she has proceeded slowly but surely in the process of "benevolent assimilation" of alien and often unwilling peoples. At the time of the conclusion of the present war numerous and plausible excuses will not be lacking for a continuance of this deplorable policy. Such a course, not unjustifiable as applied—in the interests of civilization—to barbaric tribes, would be wholly inapplicable and inequitable arbitrarily enforced against Germany's colonies. Most certainly the extension of dominion by right of conquest over East and West Africa would dissipate at once ideas of enduring equity conditioning any leadership of a "posse comitatus." No movement towards a new and true order of national and racial relations will be possible unless from the very first any selfish policy of spoliation is repudiated.

Apart from those highly proper exactions in way of repayment for injury and destruction (as to which the common consent of mankind will be freely accorded) no excessive or wanton tribute should be imposed upon the German people. Whatever form of government, retained, accepted, or set up externally or internally, by or for Germany, the German people should be encouraged to restore as speedily as possible for themselves their own prosperity.

Heretofore in the world's history the rule of the right of conquest has been indubitable: to the victors all; to the vanquished nothing, or nothing not conceded as a gratuity. In lieu of former tyrannous exactions, it will be for Great Britain to stand steadfast lest floodgates of rapacity open wide; to initiate a new order, not as ethical, but as equitable, correcting the cruel law of might and of greed, by the law of right, not because it is good, but because it is great.

It will be only by the unquestioned forbearance of the West that the East can be effectually restrained. There lies the future's peril. The wisdom of the first Napoleon was not astray in declaring that Europe was destined to become "all Republican or all Cossack." It will be for men "of good will," not apathetically to await fiats of Omnipotence concerning peace on earth, but rather to make and enforce peace themselves in the only way by which permanent peace is possible.

Instances of historical generosity (so bestial is the natural man) are rare indeed. Of the few of record the following may be briefly mentioned: After the defeat of Pompey's army at Pharsalia Julius Caesar, instead of ordering a general massacre or enslaving of the conquered, issued an order according to every man of his own forces the *privilege* of ransoming one of the enemy. It was thus that Julius made himself Caesar. After the fall of La Rochelle, the English knights taken prisoners and without means to ransom themselves, were sent under a flag of truce home to England and there set free. The English, not to be outdone, chivalrously restored to the French an equal number of captive knights. From this incident came the custom of exchange of prisoners, so greatly ameliorating war's horrors.

The interchange of kindly courtesies between Grant and Lee after Appomattox furnishes an American instance of the practical value of generous actions. And another deserves recording: when the great-hearted, wise-minded Lincoln, reproaching the vindictive of his cabinet who stigmatized playing the delightful air of "Dixie" as "treasonable," said: "Not so; we captured that tune with the other effects of the 'Lost Cause.'"

In the coming readjustment of European affairs, armaments, and frontiers, America will surely be called upon as counsellor or arbitrator. Her opportunity will be splendid. Already into American hands in every capital of the contending nations antagonistic interests have been committed. These, our envoys—ambassadors, ministers, and chargés—should be of one mind as to the spirit and purpose of mediation when the time for mediation shall come.

Doubtless it is more difficult for the onlooker to judge justly as to events and policies of his own country and time than of activities of which he is merely a spectator. At this very hour discussion is rampant concerning the course that the United States should assume to

protect its territory against possible foreign aggression. Some—so-called "Militarists"—would advocate a huge standing army; others, actuated by motives of Christian principle, find in complete disarmament, the surest defense. As to our duty—having due regard to both practicality and spirituality—perhaps a few homely illustrations may not be out of place.

Imagine a devoted missionary left alone in a land peopled by cannibal savages. Doubtless Christ-like peaceableness, gentleness, and good will, together with self-possession, and perhaps a trifle of this world's craft and subtlety, might avert assault, and secure a hearing for sound doctrine. And yet (as even the most amiable "peace-at-any-price" person will admit) immunity would depend largely upon other factors, say, the degree of hunger of the cannibals and the edibleness of the missionary.

The situation is not dissimilar when an ordinary citizen finds himself in the midst of a gang of toughs in a "boom town" or in a slum of a city. Good intentions alone can hardly be reckoned upon for protection. Let such a man beware that his dress does not violate local conventions; let him beware of any "swagger," or a hint of superiority. If he has no real errand or "call" to that neighborhood, he had better simulate one, for there is nothing a barbarian so resents as unwarranted curiosity and intrusion.

As to armament, it may be admitted that often (under circumstances above instanced) defenselessness might be the best defense; even the barbarian possesses an intuitive chivalry. Certainly the display of a weapon would irritate, as much, but no more, than a truculent manner. But it must be remembered that there is a kind of armament that no one thinks of resenting, the natural kind, undoubted fine muscular development, a carriage of body and glance of eye, denoting neither timidity nor a challenge. If in addition the citizen can call to his aid a reputation for force and courage, if he is known as "bruiser," he may be said to be invincible.

As with the individual, so is it with the nation. We talk glibly of "International Law," as if such a thing existed. There is a body of precepts, practises, and precedents, which have won a general toleration and partial acceptance, but this is custom, not legality. Law (to be worth anything) is a rule of action with a penalty for violation—a penalty enforceable. In establishing the Hague tribunal an attempt was made to legalize the peaceful consensus of opinion of civilization. In Germany's violation of Belgium's neutrality, the total failure of pacific contracts is found and the futility of a covenant not backed by overwhelming force. That Germany asserts a vital necessity serves only to emphasize the truth that "necessity knows no law."

It is for our military men, for the peace-lovers, legislators, and all

good citizens, not to demand literal interpretation of these illustrations, but to think them out, "each for himself and not for the other." Whether with our insular possessions we have intruded insolently; whether in our Monroe doctrine we have "swaggered"; these are possibly debatable questions. I do not say that our altruism will remain unrewarded by conversion of savages; but it is not yet definitely decided that the cannibals are not land-hungry, and it is very certain that the missionary is very, very edible.

The question of our national defending, not for aggression, but to prevent aggression, on sea and land, beneath the seas and in the air; this needs to be thought out and legislated out, and acted out. Upon this however full reliance may be placed: that until our great cities can dispense with an adequate police force, the nation will require the defence which trained defenders alone can insure.

Some of us, especially as to activities and non-activities in Mexico, have openly sneered at the administration's policy of prudence—of so-called "watchful waiting," candor compels confession that for one having had a military training, and withal having the strongest admiration for "strenuous" action, to refrain would have been difficult indeed. Nevertheless, in view of what is happening in Europe, the feeling can not be repressed that this policy will find justification, not in premature urgency as to our good offices, but when the day comes, as it surely will come, for an umpire, disinterested, unvexed and unhampered by affinity or collusion, as a sincere friend to all nations and to humanity, to urge and to demand guarantees of an enduring peace.

TRAINING FOR ACTION

By H. W. FARWELL
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EDUCATION is properly preparation for service. That man who enters upon his work with a poor idea of what is required of him is at once seriously handicapped and often prevented from reaching a goal which he hopes to reach, and strives to attain, sometimes with an enormous waste of energy. Much praise should be given to training which seeks to give high ideals and broad outlook, but surely something must be spoken for effort to make clear the means of attainment of a laudable ambition based on high ideals and broad outlook.

We know well the value of fundamental principles. We spend much time to ascertain what things are essential. We try to bring to younger minds the best of the results of continual analysis; yet on one point there seems to be very little effort made to make more certain the accomplishment of tasks whose essential features are readily traced to underlying principles. One of the greatest things about any work is its final solution, accomplishment or completion. The conception of a work of art, of a suspension bridge, of a transportation system, is not for all of us. There have never been too many "men of ideas." But ideas arise from imagination and only too often the plan goes awry before the final realization. The "man of ideas" needs a man with a power to accomplish.

There seems to be prevalent the notion that executive ability is a gift from nature, made to comparatively few in a generation. When one of these endowed individuals is thrust into a position of responsibility, his talent appears and success follows almost of necessity. Since this ability is rare, much time is lost in finding a man who possesses it; meanwhile, a great injustice is done to those dependent upon the executive. Such a point of view can hardly be considered fair even to the average man, for not all positions demand the highest order of executive ability.

Other people apparently assume that executive ability is a characteristic of all men, that any one in a position of responsibility, for which he has the requisite training in principles and methods, will be able to accomplish as much as any one else. How fallacious is this assumption may be quickly seen by considering the varied accomplishments of, let us say, our representatives in congress.

Executive ability is a gift from nature, to be sure, and possessed by every man, but in the same way that each man has talent for music

or for mathematics. Some have five talents and some have one. And no one would expect a young man to earn his living by means of his native musical ability without first training him to make full use of that ability. An aptitude for figures does not mean that the possessor does not need to study mathematics. That is probably what he should study most diligently. Furthermore, the discovery of nature's gifts of musical ability is not postponed until the talent is atrophied. The fond parent seeks it early and eagerly develops even a minute resemblance of talent. Why, then, is it so frequent that young men go out from school or college with no dream of their own potentialities as executives?

Specific illustrations are perhaps unnecessary, though one or two may add force to the argument. A young man, after a fine record for scholarship in high school, took up a course of scientific study in college. He found the field so alluring that he went on to a university course, taking his degree of Doctor of Philosophy with a careful and thorough research requiring a marvelous technique of manipulation. So promising was his ability that a large corporation at once engaged him to continue his work in a direction which meant much for the future of the concern. The young man found himself suddenly in an embarrassing situation. No longer was it necessary for him to spend hours searching the scientific literature for the history of a certain process; he need only direct an assistant to do this for him. The tedious watching for the results of an experiment was transferred to a subordinate. The careful manipulation of materials could be taught to an eager stripling whose idea of the significance of his work was at best vague and narrow. In the meantime the young scientist found that the direction in which he was inclined was not that of the executive, but that of the student. In a word, his education had not prepared him for the work expected of him.

A rude awakening came for another young man who had recently taken the degree of Civil Engineer. He could make long computations of stresses in girders for steel work, he could lay out beautiful curves for a railway line, but all his years of college had not trained him in the very practical problem of keeping busy and happy a party of sixty additions to the melting pot, knights of the pick and shovel. Where do the text-books state that a young engineer should never allow such an occasion to arise that one of his dusky foremen calls him by the short and ugly name, or that, the occasion having arisen, he should promptly apply a sedative by means of a convenient pickaxe handle if he wishes to maintain his self-respect and his job?

It has been claimed that plenty of opportunity is already given in school and college for the development of executive ability, both in the curriculum and in outside activities, that those men who wish training

in the management of affairs, in the handling of men, in the planning of large enterprises, have, in a small way, every chance in college that the later life affords. This is apparently true, but the real situation is quite different.

In extra-curricular interests the choice of undergraduate managers with all the rivalry of various clique-candidates has in the past called into play the methods of the ward politician rather than those of men of business ability. The system produced such woeful results, largely due to incompetence and ignorance, that of late the undergraduate managers have been themselves under the control of a man of tested value. The large opportunity has gone, sacrificed by the students themselves. In what remains, the chance is open for few comparatively, and here popularity still counts for more than real ability. At best it is work to be taken on in addition to the requirements of the curriculum, and this fact is in itself sufficient to restrain many of the most worthy from attempting more than they can do well. Further, the leaders of these activities must have time to spare for their duties, an immediate result of which is the elimination of all men who must earn their education as they go. Often these are the most in real need of the training for responsibility. And those students who carry outside work requiring business ability are generally found to be spending too large a portion of their time away from the work supposed to be of first importance.

What of the curriculum itself? In what way do the present courses of study lead a man to find himself in the particular field under discussion? More than one college president has admitted the shortcoming, sometimes on the ground that the training in college must of necessity be theoretical, sometimes that the development in the direction of affairs is new and that time is required for the readjustment. It is wrong to belittle the content of the courses offered for students to-day. The material is without question more accurate and of greater variety and amount than ever before, but, judging from the results, it does not sufficiently develop in men a very important side of their natures. They are not sufficiently acquainted with the actual working to produce results.

Perhaps the laboratories train students in the way of accurate analysis and systematic coordination. It is certain that there is opportunity for such education. A quotation from a recent laboratory manual will throw some light on the way in which this works out in practise.

> **The forms for recording results and the outlines for computation have abundantly justified the wisdom of their insertion in the immense saving of time and energy to the busy instructor. While it has been urged by some that students readily and intuitively devise explicit, symmetrical and logical arrangements for their data and computations, such students have as yet entirely escaped our observation.**

The obvious interpretation is that the authorities realize the great need of the student, but for one reason and another deliberately pass by the opportunity.

There is still much in the way of business management to be learned by the student who has his eyes open. But it must be confessed that most men are blind even to plainest of facts. The instruction is too indirect, and the operation of the plans are so smooth that it attracts no attention. The average student does not observe much of the carefully planned system which operates to give him his education; yet it would be well worth his careful study, as an example of organization.

Sometimes the beauty of a picture is lost by concentrating the attention on the technique of the artist. So, too, the teacher may fail to hold his class if he explains the method by which he commands attention. The indirect training can not be made the major part. It then loses all its value. There must be something direct and positive.

One can not overlook the existence of some very excellent schools for education in business administration, but these are not able to give to every college man what little he may need to discover within himself the ability for affairs which must in the end be developed in actual life itself. More institutions are quite unnecessary, for they would still leave the great mass of students as they are to-day. The need is for the revision of existing curricula to the end that the average student may at least know what business ability is, and whether or not he himself possesses it in small measure or in large.

DELUSIONS

By Dr. SHEPHERD IVORY FRANZ
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IT is well known that sensory stimuli are not always correctly appreciated, and that under certain conditions errors of judgment are made. These errors of perception which are not infrequent with normal people are called illusions and hallucinations. At times, especially in the insane, we find that complex situations and less direct stimuli are apprehended by an individual wrongly, and they lead to the expression of beliefs which are contrary to the experience of others, or opposed to generally accepted beliefs. Some of these false beliefs are called *delusions*. As usually defined a delusion is considered to be false belief not directly or immediately dependent upon definite sensory stimulation or upon percepts, and in this respect a delusion may be differentiated from an hallucination, a paresthesia and an illusion.

It should be understood, however, that not all false beliefs are delusional in nature. Some are clearly mistakes due to insufficient knowledge. Many years ago it was commonly believed that pelicans fed their young with their own blood. It was also generally held that the sun revolved around the earth. These beliefs were apparently due to lack of knowledge, and although the first scientist who disputed the truth of either of these beliefs opposed the generally accepted belief of the time, his beliefs were later held to be reasonable and not opposed to experience.

Other false beliefs may be due to memory defects. For example, if on a Tuesday a man should say "To-day is Sunday," the statement would be an expression of a false belief, but the expression of this belief may not in itself be an indication of the presence of a delusion. If the man had only recovered from the prolonged effects of a drug such as alcohol or morphine, under which influence he had been since the preceding Saturday, or if he had just recovered consciousness after a period of unconsciousness of three days, the expression of the belief that the day is Sunday would not in itself indicate that he was deluded. He would have good reason to believe it was Sunday. The most natural and most normal belief he could have under the circumstances would be that he had been drugged or unconscious and that he had just awakened from a period of unconsciousness. The intervening period would be for him the same as if he had been asleep.

In a similar manner mistakes in dates may be made, which are not delusional. Critics tell us that December 25, Christmas Day, is not the date of the birth of the Christ, but a date established in accordance with

the relics of pagan observances. Such a belief in the date of the nativity of the Christ is quite consistent with the beliefs of one's neighbors and with one's education and experiences.

Beliefs which are widespread and which may be called social beliefs, even though they be false, are not technically considered to be delusions. There are many popular beliefs of this kind which have no foundation in fact. The childish beliefs that it is unlucky to walk under a ladder, or to permit a pin to remain on the street if you see it, or to walk upon the cracks in the sidewalk, are examples of these. Such beliefs have probably arisen in more primitive conditions of life and the beliefs have been handed down from generation to generation, although not always in the same specific way. It has been suggested that the widespread belief regarding the harm which may ensue from leaving a pin on a pathway is due to a tradition which has come from the time when shoes and other protective devices for the feet were not as commonly used as they are at the present time. It may also have been due to the fact that these implements were expensive at one time, and that it was an indication of extravagance or lack of care if such objects were not picked up. Similarly, the belief in ghosts is also widespread and is probably the remnant of the mysterious ideas which were prevalent among primitive peoples as explanations of those things which could not be understood or explained in simple terms.

The mental association in the relation of cause and effect of two occurrences because two events have at one time been encountered in a temporal series is frequently met with among the uneducated. Similar causal connectives are believed in by those who, although educated, have not sufficient knowledge of the conditions of the phenomena with which they deal. The belief that certain individuals had supernatural powers or were in league with the devil was widespread among all classes several hundred years ago, and many people were whipped or burned because they were thought to be witches and capable of exerting an evil influence on others, such as producing sickness and death. The occurrence of sudden illness following certain actions of visitors was responsible for some of these beliefs, although the causative connection was not apparent. In these cases a certain mental "set" or attitude (the general belief in the supernatural) was the determining element which resulted in the individual beliefs. At the present time such beliefs are found among the uneducated, and they are especially numerous in communities which are isolated to a great extent from the rest of the world. Thus, the screeching of an owl is believed by some to portend coming misfortune; a dog howling at night means that some one had died or is going to die; the appearance of a strange black cat in one's house is a sign of approaching illness or ill luck (although in certain communities it is considered lucky); crows foretell misfortune; etc.

The belief that in some yet unexplored region of the earth or on some of the other planets, *e. g.*, Mars, there is to be found a race of beings intellectually, morally and physically superior to the remainder of mankind is a belief of a different character from those already considered. In regard to this kind of belief we have no definite evidence that gives us the right to say that this is not true, but neither has the individual any evidence that the belief corresponds with actual fact. Such a belief may arise because of some religious considerations, as, for example, that since the known races of man are imperfect God has also created perfect men, or has caused a race of superior beings to be developed. Or such a belief may be the consequence of a vivid dream, or a too realistic acceptance of a novelist's tale. Such a belief corresponds with the character of the belief of a child in the phenomena of birth, that babies are brought by storks or are to be found in cabbage patches, or with the belief that the moon is made of green cheese, or that there is a race of giants which eat ordinary-sized men, or that there are good and bad fairies which oversee the actions of man and reward or punish accordingly.

All of the beliefs which we have considered may be false, but simply because of their falsity they are not necessarily delusions. Characteristics other than that of falsity must be present to warrant the designation of a particular belief a delusion. Let us consider the false belief regarding the day of the week. If the individual who expresses the belief that "to-day is Sunday" when in reality it be Tuesday does not listen to reason, if, for example, he is taken to various churches and is shown that these buildings are closed at the time of day that Sunday services are announced upon the bulletin boards, and if he is taken to the business districts and is shown that the shops are open and that people are coming and going and making purchases as on a week day, and if, furthermore, the newsboys with morning or evening papers sell him a copy which shows by its date line that it is issued on Tuesday, and he still persists in his belief, there is something added to the false belief. If these evidences do not sufficiently appeal to his reason so that he gives up the belief, it may be said that, in addition to being false, the belief is *unreasonable* and *opposed to the experiences* of others in his community. There is, therefore, more reason for calling the false belief a delusion.

Although mistakes (such as that of the day of the week) may result in appropriate kinds of reactions, this has been considered to be a typical characteristic of delusions. Certain false beliefs are, however, of such a character that they lead to no reaction, although most frequently delusions do bring about behavior appropriate to the belief. The association of special activities with special beliefs is not any more characteristic of delusions than of true beliefs, and the fact that a false belief is

accompanied by behavior appropriate to the belief does not warrant the conclusion that the false belief is a delusion. The firm belief of the negro in voodoo, or of the ignorant peasant in fairies, banshees and ghosts, may result in particular types of reactions. The beliefs may be associated with behavior appropriate to the beliefs and even give rise to actions which are similar to the reactions of the insane. It must be recognized, however, that these beliefs are often consistent with the individual's previous experience and with his education. If such beliefs were held by an educated man, they would be inconsistent with his previous life and his environment; and since they are opposed to the experience and beliefs of his friends and acquaintances and bring about particular reactions on his part, we would consider them to be delusions. The ignorant negro who lies on his back when he has a pain in the abdomen or in some other part of his body, and loudly calls for his spirit to return to him shows by his actions that he believes the pain is an indication that his spirit is departing from him. His belief, however, is quite consistent with those of his neighbors, the remainder of his tribe, and they are very effective causes of action.

Under certain conditions individuals may have false beliefs, and these false beliefs for them be scientifically not delusions, although similar beliefs on the part of others would be considered delusional. Thus, for example, a child may believe that the moon is made of green cheese. This may be firmly fixed. It is not, of course, dependent upon immediate sensory stimulation and can not be corrected by an appeal to reason, but this belief is perfectly consistent with the child's previous education and training, and it does not bring about any particular mode of reaction. In the same way the belief that the sun revolves round the earth may be held by many and may, on the other hand, be quite consistent with the experience and belief of the individual's fellows, and possibly may not be corrected by an appeal to reason.

Nor is it necessary always that the delusion be a false belief. It is sometimes only necessary that the reasoning by which the individual arrives at the conclusion be abnormal or false. Thus, the belief that at the North Pole or at the top of a mountain a particular kind of rock may be found may be quite true if it is tested by experience. Lacking such experience and assuming or concluding that the special kind of rock is to be found because one has heard God whispering to him gives the false belief a character quite different from the other false beliefs which have been considered. Such a belief is rightly called a delusion, even though the truth of the fact be demonstrable. The delusional element in such a case is not necessarily the falsity of the belief, but the manner in which the conclusion or belief was attained.

Delusions have many characters. Some of them are held for only a brief period of time; they give place to other beliefs which are equally

fleeting, and for this reason they are called *changeable*. On the other hand, certain of these delusions are *fixed*. They persist for long periods of time, and although they may not remain rigidly the same, their general character persists in spite of slight alterations or elaborations.

One may also consider the delusions from another standpoint. Some of them have very few mental connections, and they do not result in forms of activity which are combined with the remainder of the individual's mentality. Apparently they do not become an integral part of his personality and they do not appear to affect him in many ways. His life is carried on as though these beliefs were not present. Such delusions we call *unsystematized*. Opposed to them we have others in which there is greater or less systematization. The belief of the patient with general paralysis of the insane that he is wealthy causes him to go out and order dozens of horses, to purchase hundreds of knives or razors, to dine at the most expensive restaurants, to commit all kinds of absurd actions which are quite consistent with his beliefs, but which are inconsistent with the experience of his neighbors. Such delusions which lead to appropriate reactions, and which dominate the activities and mind of the individual are spoken of as *systematized*. They have become a part of the individual.

From another standpoint delusions have been divided into a number of classes in accordance with the ways in which the ideas have relation to the individual. We may speak, therefore, of *somatopsychic* delusions when the delusions refer to the body, of *autopsychic* delusions when they refer to the personality, and of *allopsychic* delusions when they refer to the external world. These different classes are not always distinct, and it is not always possible to classify all delusions in this manner. As examples of these delusions the following may be cited: of the somatopsychic, the individual may believe there is a snake or rabbit in the abdomen, or that the abdomen does not contain its full quota of organs, or that the individual has lost a leg or that the whole body is missing; of the autopsychic, delusions of poisoning (possibly also somatopsychic), the individual has very great strength or power, he has a hypnotic eye; of the allopsychic, those in relation to the external world, the individual may be a Messiah, he has committed the unpardonable sin. There are many varieties of these referring to the different parts of the body and to the different relations of parts, and at the same time the somatopsychic, the allopsychic and the autopsychic may be compounded into one.

Some delusions have a gradual growth, others are almost fully developed in an instant. The latter are usually found associated with hallucinations, or strictly speaking, they themselves may be hallucinations. If we consider the mode of development of one of these delusions, we shall realize this. Let us say, for example, that an individual

expresses a belief that he is a king. This delusion, when analyzed, or carefully observed during its development, is found to result from processes like the following. The individual has always been poor; he has had very great difficulty in making sufficient money to purchase for himself food of the character he craves, or to buy clothes to keep himself clean and respectable in appearance. At times, because his views of life have been different from those of his companions, he has found that he has been associated with other people of his own financial situation with whom he has not been *en rapport*. Their mental and moral coarseness has jarred upon him and caused him to believe that he is somehow and in certain particulars quite different from those with whom he normally associates. Then he finds it difficult to obtain a position. Owing to his inefficiency he loses one position after another, and because of his belief that he is different from his co-workers, there comes the next step in the delusion formation, the belief that people are down upon him, or are persecuting him. The final step is easy. The reasons for the persecution are sought; he considers various possibilities; he thinks about his past life, of the various positions from which he has been separated owing to no fault of his own (as he thinks); he sees no definite connection between the losses of his positions and his own incompetency, or between his lack of harmony with his fellow workmen and his own mental condition; he begins to believe that there must be some united effort to bring about these adverse conditions. Sometimes he believes this external influence is exerted by the Masons; sometimes it is one or other of the churches; and at other times he believes his difficulty has been due to the fact that his social position, if known, would be higher than that of those who persecute him. Eventually he comes to believe that he is a legitimate son of a certain ruler, and that all of his troubles have been due to the fact that in childhood, or perhaps in babyhood, another infant or child was substituted for him and that various difficulties have been made to prevent his assuming his proper place and to keep him down. From these beliefs it is an easy step to the belief that he is to be the lawful king when his supposed father dies. In general, such is the mode of development of the so-called systematized delusion which arises gradually, and which is thought out.

On the other hand, delusions may arise suddenly as if by inspiration. These latter, as has been previously suggested, usually come because of particular kinds of hallucinations which convey messages indicating the individual's supposed greatness or his unworthiness. Here the auditory hallucinations usually play the most important part. The voice of God may be heard telling him that he is the Messiah, or he hears voices constantly saying that he must be kept out of the way in order that another may have the place which lawfully belongs to him,

or he hears a voice calling him evil names, and in the presence of such hallucinations, a delusion may suddenly arise. Other delusions of apparently sudden origin probably arise from other causes, some of them being the end result of a number of experiences, hallucinatory it may be, no one of which by itself has been sufficiently powerful to beget a delusion.

The somatopsychic delusions, Southard has well shown, may arise because of, or be concomitant with, stimuli resulting in particular kinds of sensation in particular parts of the body. Thus, he describes the case of a woman who expressed the belief that she had been shot in the breast with a "seven-shooter." The patient could not show any signs of a wound, nor were there any external signs visible. There were noted pleuritic friction sounds and the autopsy revealed a fibrous pleurisy at the point at which she believed she had been shot. Whether or not the form of the delusion, namely, the belief in being shot, was due to other experiences, can not be determined. In this case the conclusion that there is a relation of the particular pathological condition of the pleura and the definite ideational localization of the point of the shot with the somatopsychic delusion is not only suggested, but almost forced upon us. The ideational selection of the particular weapon (a seven-shooter) may be indicative of other causes which acted in conjunction with the abnormal sensations.

Other cases which Southard has reported have equally suggestive histories indicating that the abnormal sensations from different parts of the body may give rise to delusions of a somatopsychic character. Thus, he has recorded the case of a man who complained of torpidity of the bowels. This patient almost constantly kneaded his right chest and abdomen because of this supposed condition. At the autopsy a number of pathological states were found in the region to which he referred his delusion, and one of these, namely, the right lung was adherent to the pleura, is sufficient to mention. Another patient complained that his stomach was always full and that he could not eat, and this belief was found to be associated with the pathological finding of intestinal obstruction from cancer. In this case probably the passage of food stuffs from the stomach into and through the intestines was retarded, and it is not difficult to conclude that the belief that the stomach was full had, partially at least, its origin in, or was built upon the foundation of, the abnormal sensations which accompanied the morbid modes of gastric and intestinal activity. The accumulation of cerumen in the ear of another patient was accompanied by the belief that bugs or buzzing flies were present.

Two other cases in which no peripheral lesions were found to correspond with the delusions are cases in which cerebral lesions were found to accompany the beliefs, (1) that the insides were gone and,

(2) that there was gravel in the head. The examination of the brain of the first of these cases revealed lesions in the optic thalamus. When we recall the fact that the thalamus is a subsidiary, although very important, sensory ganglion which receives the nervous impulses corresponding with the sensations of touch, pressure, temperature and pain, before these impulses are passed onwards to the cerebral cortex, and that in the non-insane lesions of this ganglionic mass result in anaesthesias, it is not difficult to understand that this particular cerebral lesion may have a very definite relation to the belief that the insides are gone. A similar correlation has also been recorded by Southard in the case in which the belief that "the insides were gone" was associated with a lesion in the cerebral postcentral gyri (sensory center).

It will be noted that these cases in which somatopsychic delusions are associated with variations in the sensations from the bodily periphery resemble those conditions which are grouped under the general heading of illusions. In certain cases those beliefs which are apparently delusions might very readily be considered to be paresthesias (illusions), but there is one particular in which they sometimes differ, viz., the delusions can not be correlated with definite changes in parts of the body until after death. This is especially true for those cases in which the delusion or false belief has been associated with a lesion of part of the cerebrum. If we should carefully and consistently omit from the class of delusions all those conditions in which there are concomitant physical abnormalities which might result in sensory abnormalities, we should probably classify the above cases of Southard with illusions or hallucinations. Since, however, many of the physical pathological conditions can not be determined until after death, we should need to withhold any particular designation until after that event, and an accurate designation could not then be made unless an autopsy were performed. It would therefore not be possible to distinguish between delusions and illusions and hallucinations. Obviously the matter must be settled in a more practical manner and it appears best to designate the more definite interpretative elaborations as delusions regardless of their source. Thus, internal ear diseases may result in sensations which give rise to the reports that "there is a buzzing in my ears," or "people are talking about me," or "there are bees in my head." Since it is not possible to determine in every case the definite relation of an idea to a particular stimulation the interpretative additions of the last two forms of reaction give warrant for the designation of delusion. The indefiniteness of the "buzzing in my ears" is similar to the well-known paresthesias of tingling and formication, and may be classed with these, even though the morbid process leading to the abnormal sensations be unknown. The interpretative elaboration may in these cases be the only criterion differentiating the delusion from an hallucination or an illusion.

On the other hand, there are numerous delusions which are undoubtedly due to what Freud and his school call a "wish fulfilment." Burrow had described such a case. An unmarried woman for a number of years had complained of weakness, indigestion, distension of the abdomen, pain in the back and groin, which conditions, as far as could be determined, were not associated with any abnormal physical state. A psychoanalysis of this patient showed that she had had very great desires to be married; her dreams were of marriage and of bearing children; and her mental life had been colored by or made up largely of these wishes. The physical conditions of which she complained were taken by Burrow to be the outward signs of the conditions which she hoped she might have, namely, those of pregnancy as a result of marriage. Jones has also well described a case of a similar nature. This woman exhibited erythrophobia, *i. e.*, fear of red, and at the same time she believed that she was responsible for or had actually caused the death of her mother. A careful mental examination showed that for many years she had been compelled to remain at home to take care of her mother, who was an invalid, that because of this she had been unable to have pleasures similar to those which she found girls of her age were having, and from time to time these conditions led to rebellious ideas. The health of her mother improved to such an extent that she was enabled to go to college or school and thus again take up her life in association with other girls. At school there was a debate in which she took part and in which, as one of the contestants on one side, she wore a red shield on her arm. Subsequent to this event she dreamed of seeing her mother lying dead, in a room on the wall of which there was a red shield. On account of worry over her dream, she went home, taking the red shield with her. She was pleased to find her mother very well and, laughingly explaining her fears, she pinned the red shield on the wall of her mother's room. A day or two later upon awakening in the morning, she went to see her mother and found her dead in bed. Thence, it is explained, originated her belief that the act of pinning the red badge upon her mother's wall had something to do with the death of her mother, and thence also arose the fear of red. It was also learned that because of the lack of pleasure in life she had at times considered how much better off she would be if her mother were dead, and perhaps had also unconsciously wished for such a solution of her difficulties. When, however, there was accomplished the actual result which she had wished, her action in placing the red shield upon her mother's wall became prominent in her mind and she believed she had been warned about this in her dream.

Numerous other cases of a similar character might be cited. Most if not all, delusions are interpreted by the Freudian school in this manner. Brill, for example, interprets certain delusions of grandeur

as being due to an overestimation of the self (of a sexual character), and the Freudian conception of paranoia, with its fixed and systematized delusions, is that it is a defense reaction of this nature. The symptoms are due to unconscious elements which act in a fashion somewhat similar to, although more powerful than, conscious ideas. These types or cases may be considered to be somewhat different from those of Southard in that they are of an ideational rather than of a sensory type.

On the other hand, we sometimes find delusions which can not be considered strictly ideational or strictly sensory in character, and it is very likely that many of the so-called ideational cases have certain sensory elements, and on the other hand that certain of the sensory cases have ideational elements in them. Such a case, with details learned at a time when the delusion was at its height, is the following; the patient was a woman who had been in love with a young man whom her mother considered to be entirely unsuitable, and because of this kept the man away from the house and, by her insistence, practically compelled the daughter to marry another man who was wealthy and socially more eligible. The man whom she married she did not love and, in fact, very much disliked. She bore several children to him, but believed that their relations were not morally right. Because of her ideas and her dislike for her husband she had lacked normal enjoyment in her married life and had frequently longed for death. Eventually she exhibited signs of insanity and was committed to a hospital. She continually said she was dead, that the physician might cut off her finger or her arm or her head without finding a drop of blood. She was not particularly untidy; she could do accustomed things very well; she dressed herself; she walked and talked and in her actions gave a lie to the beliefs which she expressed, but it was impossible to shake her belief either by reference to her acts or in any other manner. She was completely anesthetic and analgesic. This case shows physical signs, namely, anesthesia and analgesia, which may be correlated or believed to be correlated with the delusion, and on the other hand there are elements in the history similar to those which were found in the cases of Burrow and Jones. It was not determinable whether the anesthesia preceded the belief in her nonexistence or the reverse.

A fourth class of delusions is not infrequently encountered. In cases of arteriosclerotic or senile dementias or in a Korsakow's syndrome patients frequently recount their journeys of the night before; they tell how they had been fishing the previous day; they had been brought to this hotel (the hospital) an hour or two ago, or have had visits from friends, when none of these things had occurred. Here the delusion appears to be based upon memory lapses or defects. The patient does not remember the occurrences of yesterday, even those of the same

morning, and the memory gaps are filled out by the patient, often with those occurrences which the patient would like to have had occurred. In this way such delusions may be considered to be allied to the ideational type, those of wish fulfilment which were described above.

An amnesia may lead to a delusion or false belief regarding the locality of a given place. An excellent example of this has been described by Alzheimer. A Russian who had emigrated, and located in Frankfurt, was taken to a hospital, where he insisted that he was in Russia. He could not recall any of the incidents of his removal from Russia and the period of time between his emigration from Russia until his admission to the hospital was lost from memory. The most natural conclusion for the patient under these circumstances was that he continued to be in Russia. Such a disorientation may be considered to be a delusion due to the lack of recognition of dissimilarities.

Kraepelin cites a somewhat similar case, due, however, to a different kind of memory defect, which was described by Ganser. This patient was a boy who had been admitted to the Munich psychiatric hospital who insisted that he was in Vienna. He also believed that he had been asked to join a company for the development of the Sahara Desert, that he had been in London to consult with others regarding this, and had just returned to Vienna in a balloon. The whole story was bizarre and apparently without reason, until it was subsequently learned that the patient had borrowed practically the whole system of ideas from a novel which he had read some time previously. He had forgotten the fact that he had read the book, but he remembered the incidents, and since the incidents could not be given their proper setting he assumed that they had happened to him. In this case the defect of memory was a defect in the sense that previous occurrences were not properly located as to personality. The special incidents were suitably remembered, but the reference of them was erroneous.

Closely associated in character with the delusions which have just been described are others which the French call "*deja vu*" and "*deja entendu.*" These are conditions in which the individual experiencing them believes that he has had similar experiences in the past. In a perfectly new situation, in a place which he has never before visited, a person believes that he has been a visitor there at some previous time. Or words which are read in the newspaper or words that are heard are believed to be exactly the same as others which he has experienced in the past, not only with respect to the individual words or their combination, but also with respect to their context and their meaning as applied to him. These feelings of having already experienced such situations are frequently due to memory defects. But in these cases the memory defects are of quite a different character from those in the cases which have previously been described. In the condition of "*deja vu*"

it is probable that what takes place is that one or several elements in the present situation are like those which had been experienced in the past, but that the dissimilarities in the situations are not observed. The individual has a memory defect in that he parallels or identifies a complex present experience with a similar complex past experience, although in the present experience the number of elements which are the same as those in the past may not be very great. In other words, the present experience is deemed to be the same as that of the past because of the fact that the past is not accurately remembered and properly localized in time.

Throughout all of these delusions one may discover that, in general, there are two ways in which they arise. As far as can be determined, Southard points out, the patients take data which are erroneous, such as the lack of sensation (anesthesia) and interpret the lack of normal sensation in a normal manner, viz., lack of sensation means that the part is missing. By a normal individual a different interpretation may be made, but the delusional interpretation is, it should be understood, equally logical. We may conclude, therefore, that delusions are sometimes due to the fact that abnormal sensory conditions are appropriately and logically interpreted. On the other hand, these delusions may also arise because of abnormal or faulty methods of interpreting the data which are correctly received by the patient. Thus, the woman who experienced a pain due to pleurisy did not say "I have a pain in my chest," but "I have been shot in the chest." In every case it is not always possible to determine whether the delusions are due to elements of abnormal data or elements of abnormal reasoning. It is possible that in every case both of these elements are to be found. As a rule, in those who are not mentally unbalanced anesthesias and pains do not lead to delusional interpretations. When the sciatic nerve has been cut in an otherwise normal individual the lack of sensations which are normally received from the foot and leg does not lead to the interpretation that the foot or leg has been cut off or is missing. Experiences through other channels of sense are added and are combined to interpret the phenomena in a normal manner. The leg exists, but it is not felt. The lack of feeling does, however, imply non-existence and this conclusion is most direct. Correction of this interpretation because of sensations obtained from other sources (*e. g.,* the eye) are indirect. It is perfectly logical for the man suddenly stricken blind to believe that it has suddenly become dark. It is only by an extension of experience and by the utilization of other means of arriving at a conclusion that the logical interpretation gives way to what may be termed a "normal" interpretation. The formation of delusions as the result of abnormal modes of interpretation is probably most frequent.

DUCTLESS GLANDS, INTERNAL SECRETIONS AND HORMONIC EQUILIBRIUM. II

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In the first half of the nineteenth century the accepted view of the phenomena of secretion was that enunciated by Johannes Müller, viz., that the process consists of two phases—secretion proper, or the casting out of substances upon a surface inside the body, as in the case of the gastric juice; and "excretion" or the voiding of such secreted substances into the external world, as in the case of bile or urea. This distinction was somewhat artificial, since bile, urea and other excreted substances are also secretions in the first instance. In 1801[16] the French physiologist Legallois, as Gley has noted, surmised, from the identity in composition of all varieties of arterial blood and the diversity of venous blood in different parts of the body, that this diversity is acquired, in each case, from the loss of some substance to the organ from which the vein proceeds. Thus Bordeu's idea: A (arterial blood) $= S$ (secretion) $+ V$ (venous blood), and Legallois's idea: V (venous blood) $= A$ (arterial blood) $- S$ (secretion) are identical. When A and S are chemically known, A being constant, V will be known; or, when A and V are known, S will be known. V is always a variable. This remarkable intuition of Legallois, like the hypothesis of Borden, remained on a theoretical basis and was not put to experimental proof. In 1849, A. A. Berthold,[17] a Göttingen professor, is said to have transplanted the testes of a fowl to another part of its body, with complete retention of its sexual characters, a phenomenon which he inferred to be due to "the productive relation of the testes, *i. e.*, to its effect upon the blood and thence through the corresponding effect of such blood upon the entire organism." This *aperçu*, again, does not differ materially from that made by Bordeu in the eighteenth century. In the meantime the ductless glands were coming to be known among the German physiologists as "blood-vessel glands" (*Blutgefässdrüsen*) or "blood glands" (*Blutdrüsen*) and were regarded by the histologists Henle and Kölliker as preparers of different chemical substances which are utilized by the organism through the blood. Beyond this general theory, which is identical with Bordeu's, no special function could be assigned to the different ductless glands. Even Henle asserted that these glands have no influence whatever upon animal life, that they can be extirpated or undergo pathological degeneration without affecting either the sensory or motor functions of the body. The path-breaking importance of Addison's great monograph on the effect of disease of the suprarenal capsules may be thrown into relief by citing Hyrtl's witticism about the suprarenal—that the un-

[16] Legallois, "Œuvres," Paris, 1824, II., 209–210. Cited by Gley.

[17] Berthold, *Müller's Arch.*, Berlin, 1849, 42.

known nature of its functions insures it from bothersome investigation at the hands of medical men (*"Die unbekannte Funktion der Nebenniere sichert dieses Organ von lästigen Nachfragen in der Heilwissenschaft"*).

If we regard the lungs or the individual cells of the body tissues provisionally as ductless glands, then it will be perceived that the truth of the equation formulated by Legallois had already been demonstrated quantitatively when Lavoisier proved that inspired air is converted into carbon dioxide and water, and when Lagrange, through his pupil Hassenfratz, proved that the oxygen in inspired air, being dissolved in the blood, takes up carbon and hydrogen from the body tissues as the blood courses through them (1791). We now know that the respiratory center in the medulla is stimulated by the CO_2 in the venous blood, which Lavoisier and Lagrange had shown to be, in effect, a true metabolite, or waste-product of tissue-oxidation. Their work was in fact the starting point of the chemical study of metabolism, which received its next great advancement in Claude Bernard's study of glycogen; for although the latter may not be, in the strict sense, a true internal secretion, discharged from a gland into the blood, yet its investigation led Bernard to the classical statement of the doctrine of internal secretions as such:

> In animals, the glycogenic secretion is an internal secretion because it is discharged directly into the blood. I have considered the liver, as found in the higher vertebrates, as an organ with a double secretory function. It seems to reunite, in effect, two distinct secretory elements and it represents two secretions, one external, the biliary secretion, the other internal, the glycogenic secretion, which is discharged into the blood.[18]

In the year 1843, Claude Bernard, in his graduating thesis, made the discovery that cane sugar is acted upon by the gastric juice, being converted by it into dextrose. This experimental fact led to a train of reasoning which was to revolutionize the physiology of nutrition and metabolism and at the same time to introduce the new concept of internal secretions and to be the starting point of the experimental production of disease by the artificial use of chemical and physical agencies. All carbohydrates, Bernard reasoned, must get into the blood in the form of dextrose. "What becomes of this dextrose?" he next inquired. Somewhere between the alimentary canal (*via* the portal vein) and the liver, between the liver (*via* the right heart) and the lungs, between the lungs (*via* the left heart) and the various body tissues, this dextrose is either destroyed and disappears or is transformed into some other substance. If the locus of this transformation could be discovered and its activities inhibited, an artificial diabetes might be produced by the induction of excess of sugar in the blood. On feeding a dog on rich sugar diet and killing it at the height of digestion, he found the hepatic veins loaded with dextrose, and although this looked at first as if the

[18] Bernard, "Leçons de physiologie expérimentale," Paris, 1855, I., 96.

liver was not the site of transformation, Bernard changed his mind when he found that the blood from the hepatic vein of another dog fed upon meat only (a sheep's head) was also loaded with grape sugar. Thus it appeared that the liver is a sugar-manufacturing plant, and that its sugar-producing or glycogenic function is in the nature of an internal secretion, a view which he confirmed by many varied experiments, publishing his results in 1849–50. About the same time he discovered that a puncture in the region of the fourth ventricle of the brain in the dog will produce a temporary diabetes (1849), which the later researches of Harvey Cushing and his associates indicate to be a polyuria deriving from the pituitary body. As a simple decoction of the liver substance was always found to contain dextrose, the next step was to ascertain how the liver produced this substance at the expense of the materials sent from the alimentary canal. After perfusing a freshly excised liver until the wash-water from the hepatic vein contained no sugar, Bernard found that if the liver were left in a warm place for a few hours a subsequent perfusion would once more come out loaded with sugar, and, although this property of the hepatic tissue could be destroyed by boiling, the sugar-producing power could be restored by adding to a decoction of the boiled liver a small quantity of fresh liver infusion. From this he inferred that the glycogenic function is, in effect, a fermentative process and that its agency is a kind of starch. In 1855 he succeeded in obtaining this glycogenic substance in the form of a dry powder, which could be converted into dextrose by fermentation, although it did not itself respond to the sugar tests. In 1857, by his potash-alcohol process, Bernard obtained it in the pure state as "glycogen." It was the fact that glycogen could be seen, touched, tasted and experimented upon as such that established the theory of internal secretions as a working principle in physiology. The epoch-making character of Bernard's discovery is best indicated in the language of Sir Michael Foster, who has given the most fascinating appreciation of his work in medical literature:

> The view that the animal body, in contrast to the plant, could not construct, could only destroy, was, as we have seen, already being shaken. But evidence, however strong, offered in the form of statistical calculations, of numerical comparisons between income and output, failed to produce anything like the conviction which was brought home to every one by the demonstration that a substance was actually formed within the animal body and by the exhibition of the substance so formed.
>
> No less revolutionary was the demonstration that the liver had other things to do in the animal economy besides secreting bile. This, at one blow, destroyed the then dominant conception that the animal body was to be regarded as a bundle of organs, each with its appropriate function, a conception which did much to narrow inquiry, since when a suitable function had once been assigned to an organ there seemed no need for further investigation. Physiology, expounded as it often was at that time, in the light of such a conception, was apt to leave in the mind of the hearer the view that what remained to be done consisted chiefly in determining the use of organs such as the spleen, to which as yet no definite

function had been allotted. The discovery of the glycogenic function of the liver struck a heavy blow at the whole theory of functions.

No less pregnant of future discoveries was the idea suggested by this newly found out action of the hepatic tissue, the idea happily formulated by Bernard as "internal secretion." No part of physiology is at the present day being more fruitfully studied than that which deals with the changes which the blood undergoes as it sweeps through the several tissues, changes by the careful adaptation of which what we call the health of the body is secured, changes the failure or discordance of which entails disease. The study of these internal secretions constitutes a path of inquiry which has already been trod with conspicuous success and which promises to lead to untold discoveries of the greatest moment; the gate to this path was opened by Bernard's work.[19]

In 1856, one year before Claude Bernard obtained glycogen in the pure state, the doctrine of internal secretions was put upon a firmer basis through the important experiments of Brown-Séquard and Moritz Schiff. Only a year after the publication of Addison's great monograph on suprarenal disease, Brown-Séquard succeeded in producing an exaggerated form of Addison's disease in different animals by removal of the suprarenal capsules, the symptoms being the same and the result of the experiment being rapidly and invariably fatal.[20] If only one capsule were removed, there was no appreciable change in the normal animal, but death would rapidly supervene upon removal, even after a long interval of time, of the other capsule. Furthermore, Brown-Séquard found that a transfusion of normal blood into the veins of an animal deprived of its suprarenal capsules will prevent its death for a considerable time, indicating that the normal suprarenal capsules secrete a material which is necessary for the maintenance of life. In the same year (1856), Moritz Schiff,[21] of Frankfort on the Main, found that excision of the thyroid gland in dogs is invariably fatal. His results were forgotten for over twenty-five years, when, following the description of myxœdema by Gull (1873) and Ord (1878) and the first excision of the thyroid gland for goitre by the Swiss surgeon, Theodor Kocher (1878), J. L. Reverdin of Geneva showed that an "operative myxœdema" is produced in man by complete excision of the thyroid (1882). This was confirmed by Kocher, who found that total thyroidectomy is followed by a "cachexia strumipriva" or "cachexia thyreopriva." Hereupon Schiff returned to the charge and, in 1884, published the results of 60 thyroidectomies in dogs, all fatal, with such significant symptoms as tremor, spasms and convulsions. What is more to the purpose, Schiff demonstrated that these symptoms could be prevented by a previous graft of a portion of the thyroid gland beneath the skin or into the peritoneal cavity of the animal, or by the injection of thyroid juice into a vein or under the skin, or by the ingestion of thyroid juice or raw thyroid by the mouth. This led in time to the remarkably successful treatment of myxœdema by means of thyroid

[19] Sir Michael Foster, "Claude Bernard," London, 1899, 89–90.

[20] Brown-Séquard, *Compt.-rend. Acad. d. Sc.*, Paris, 1856. XLIII., 422; 542.

[21] Schiff, "Imparziale," Florence, 1863, 234–237.

extract by Murray and Howitz in 1892. In 1884, Sir Victor Horsley produced an experimental myxœdema by removal of the thyroid in monkeys, which were found to survive much longer than dogs. It was also found by Allara (1885), Ewald (1890) and others, that experimental thyroidectomy is negative in birds, rodents and herbivorous animals, and that, both in animals and man, operative myxœdema is produced less frequently as age advances. In 1888,[22] Sir Felix Semon, in an important collective investigation, showed that cretinism, myxœdema and operative myxœdema (eachexia thyreopriva) are one and the same. In 1889, Brown-Séquard, then aged seventy-two, found himself vastly rejuvenated as to general health, muscular power and mental activity, by the subcutaneous injection of testicular extracts, the active principle of which Poehl, the Russian physiologist, holds to be the substance spermin ($C_5H_{14}N_2$). These experiments of Brown-Séquard easily lent themselves to ridicule, but he followed them up, even to the extent of giving pituitary extract for disease of that organ (1893), and it was his work upon these extracts which led him to formulate the following statement of the old Bordeu theory of internal secretions:

> All the tissues, in our view, are modifiers of the blood by means of an internal secretion taken from them by the venous blood. From this we are forced to the conclusion that, if subcutaneous injections of the liquids drawn from these tissues are ineffectual, then we should inject some of the venous blood supplying these parts. . . . We admit that each tissue and, more generally, each cell of the organism secretes on its own account certain products or special ferments which, through this medium, influence all other cells of the body, a definite solidarity being thus established among all the cells through a mechanism other than the nervous system. . . . All the tissues (glands or other organs) have thus a special internal secretion and so give to the blood something more than the waste products of metabolism. The internal secretions, whether by direct favorable influence, or whether through the hindrances of deleterious processes, seem to be of great utility in maintaining the organism in its normal state.[23]

As theory goes, nothing new has been added to the doctrine of internal secretions since Brown-Séquard stated it in this form in 1891. In his essay on "Variation" (1868) Darwin seems to have had a glimmering of the idea when he stated that gemmules are transported from all parts of the body to the ovum to insure their reproduction (pangenesis), and the Bayliss-Starling doctrine of the "hormones" or chemical messengers, as we shall see, is not essentially different from that of Bordeu and Brown-Séquard.

From the time of Brown-Séquard on, experimental investigation of the subject moved so rapidly and in so many different directions that the general trend of the theory became obscured or lost in the details of controversy. And further obfuscation was brought about by the constant succession of dissolving views of the subject of carbohydrate

[22] *Tr. Clin. Soc.*, London, 1888, Suppl. to Vol. XXI.

[23] Brown-Séquard, *Arch. de physiol, norm. et path.*, Paris, 1891, 5 s., III., 506. Cited by Gley.

metabolism. In 1886, von Mering produced an experimental diabetes by the ingestion of phlorhizin. In 1889, von Mering and Minkowski obtained diabetes by an experimental excision of the pancreas.[24] The histological, pathological and clinical studies of E. I. Opie (1901), L. W. Ssobolew (1902) and W. G. MacCallum (1909), indicated that the source of this pancreatic glycosuria is to be found in a specialized group of cells, called the islands of Langerhans. Thus it would appear that the pancreas possesses an internal secretion as well as a digestive function. The discovery of iodothyrin in the body by Eugen Baumann, in 1896, suggested the relation of the thyroid gland to iodine metabolism and an adjoining pair of ductless glands, the parathyroids, discovered by the Swedish anatomist, Ivar Sandström, in 1880, would appear, from experiment, to have an influence on calcium metabolism. In 1891, Eugen Gley showed that where excision of the thyroid is negative in certain animals, these animals will speedily die if the four parathyroids are also removed. In 1892, the Viennese surgeon Anton von Eiselsberg made a successful transplantation of the parathyroid glands from the neck to the abdominal wall in a cat and showed that tetany may be produced upon its removal from this site. Subsequent experiments by H. Leischner (1907) and by W. S. Halsted, at the Johns Hopkins (1909), showed that the production of tetany is really due to removal of the closely adjacent parathyroids. These observers found as in Schiff's experiments, that the tetanoid spasms will be abolished upon injection of an extract of the gland or after parathyroid feeding or upon regrafting the gland itself. In 1908 W. G. MacCallum and C. Voegtlin showed, at the Johns Hopkins Hospital, that tetany may be abolished by treatment of the patient with calcium salts. Another ductless gland, the pituitary body, has been shown to have a marked relation to carbohydrate metabolism and, like the suprarenal and parathyroids, to be essential to the maintenance of life. The pituitary body, which the anatomist Soemmering called the hypophysis cerebri in 1778, was, as we have seen, regarded as an organ discharging a mucous secretion into the nostrils until this theory was disproved in the seventeenth century. This structure consists of an anterior glandular lobe (pars anterior) and a smaller posterior lobe (pars nervosa), the whole being connected with the floor of the fourth ventricle of the brain by means of a stalk or infundibulum. In 1838 the embryologist Rathke showed that the anterior lobe is developed by the protrusion of an ectodermal pouch (Rathke's pouch) from the roof of the pharynx and is made up of epithelium derived from the buccal cavity. It lies in the embryonic rest of Rathke's pouch "as a ball is held in a catcher's mitten" (Cushing). The posterior lobe is made up of nervous tissue and is derived from a corresponding prolongation from the anterior

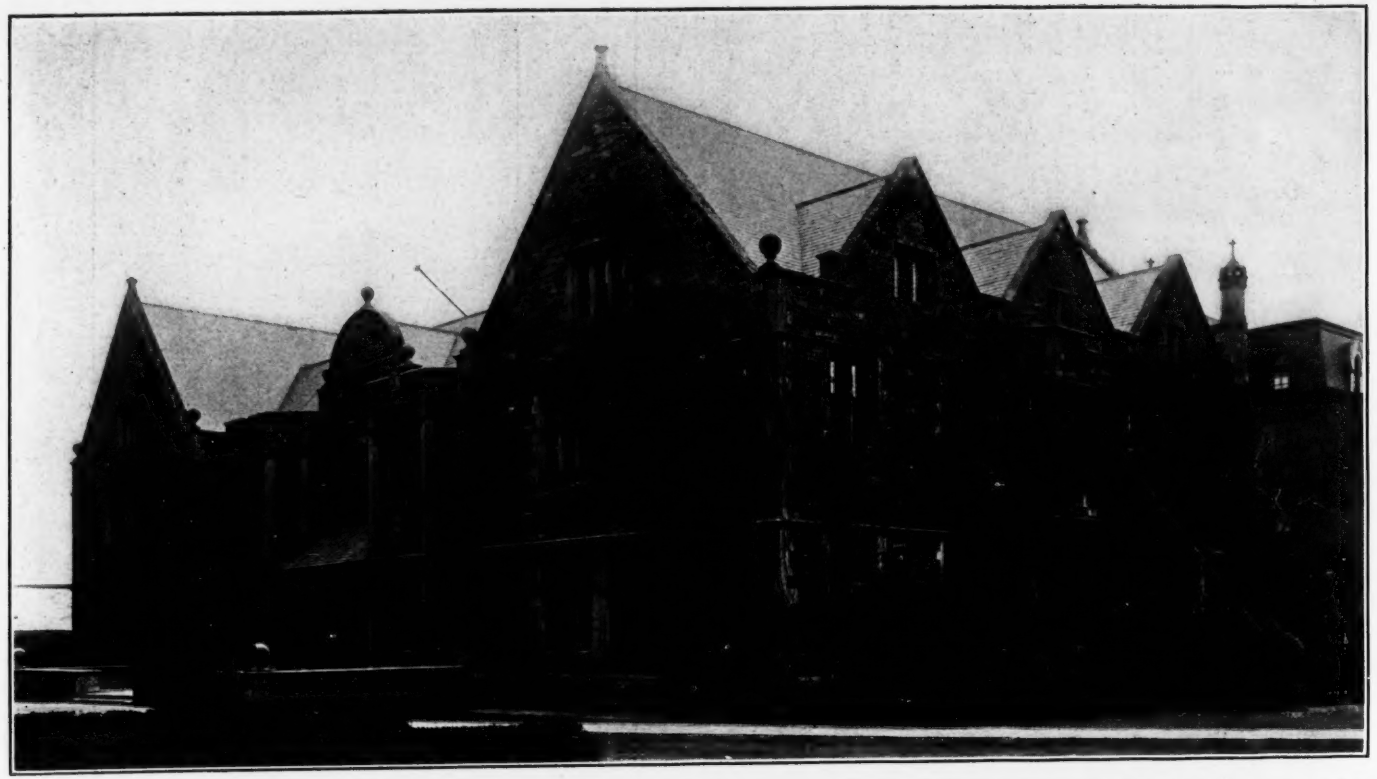
[24] Von Mering and Minkowski, *Arch. f. exper. Path. u. Pharmakol.*, Leipzig, 1889, XXVI., 371.

cerebral vesicle. Until recently the pituitary body has been inaccessible to surgeons and to physiological experimenters by reason of its encasement in the sella turcica of the sphenoid bone. Experimental removal of the pituitary (hypophysectomy) was essayed by Horsley (1886), Marinesco (1892), Vassale and Sacchi (1892–4), Gatta (1896), Biedl (1897), von Cyon (1898–1900) and others, with negative or contradictory findings, resulting no doubt from the difficulties encountered in approaching the gland through the skull and of insuring its entire removal under these conditions. In 1908, an important advance was made by Nicholas Paulesco of Bucharest, who devised an operation by the temporal route and showed that the pituitary body is essential to life, its removal being fatal to the animal. At the same time, he found that removal of the anterior lobe is equivalent to entire removal and that excision of the posterior lobe is negative. Paulesco's experiments were put to the test by Harvey Cushing, now professor of surgery at Harvard, and his associates at the Johns Hopkins Hospital, their experiments being performed mainly upon dogs. They found that total removal or removal of the anterior lobe alone are alike fatal, the animal dying in three days with a peculiar train of symptoms consisting of lowered temperature and blood pressure, sluggishness, unsteady gait, rapid emaciation, slowing of pulse and respiration, diarrhœa, diminished urine in adults; polyuria and glycosuria in puppies. Partial removal of the anterior lobe in normal dogs was found to produce a pronounced state of obesity, with a remarkable shrinkage of the external (male) genitalia. In other words, Cushing produced, by experiment, a genuine pathological reversion to the condition known as sexual infantilism or "dystrophia adiposo-genitalis" (Fröhlich's syndrome). In the case of the posterior lobe, which, as shown by Cushing and Goetsch, discharges its secretion into the cerebro-spinal fluid, partial removal or the production of insufficiency of the secretion by putting a clip upon the stalk of the gland, produces, at first, a temporary lowering of the animal's assimilation-limit for sugars, followed by a marked and permanent increase in its tolerance for carbohydrates, which is again promptly lowered by injection of an extract of the posterior lobe. In 1895 Oliver and Schäfer found that the mammalian pituitary possesses an active principle which, upon injection, elevates the blood pressure and increases the force of the heart beat. In 1898 Professor William H. Howell, of the Johns Hopkins University, showed that this property is possessed by the extract of the posterior lobe alone. In his Harvey Lecture of December 10, 1910, Cushing introduced the pathological idea of "dyspituitarism" or perverted function of the gland, as a generic concept, covering excess or insufficiency of its function, and for the following reasons. In accordance with the clinical and pathological findings of Parry, Graves and Basedow, exophthalmic goiter was regarded as a state of "hyerthyroidism," or excessive secretion of the gland, while the myxœdema of Curl-

ing, Gull and Ord was termed "hypothyroidism" (diminished secretion or insufficiency). But it was found that, in many cases the two conditions may be blended, as Paracelsus had originally surmised in the Salzburg region, producing an overlapping of the cardinal symptoms of either. For this condition, the term "dysthyroidism" was proposed by Marie for both. In like manner, states of over activity in the pituitary (hyperpituitarism) or of under activity (hypopituitarism) may be superimposed, one upon the other, making the term "dyspituitarism" most appropriate in the majority of cases. As a goitrous mother may have a cretinous infant, so, as originally observed by Crookshank and confirmed by Cushing, a big, bony acromegalic woman may have a son afflicted with pituitary infantilism or obesity. Cushing has also shown that there is evidence of pituitary activity in pregnancy and hibernation (1912) and his experiments upon its relationship to the sympathetic nervous system (1913) have led him to the conclusion that a lesion of the posterior lobe is the principal cause of the increase of normal urine (polyuria) otherwise known as diabetes insipidus. Finally, he had devised a standard surgical procedure for approaching the almost inaccessible pituitary gland, which was first operated upon in man with success by H. Schloffer in 1907. Cushing's work is thus a brilliant contribution to physiological or Hunterian surgery which had almost fallen into abeyance until the twentieth century and which has been the principal means of elucidating the obscure physiology of the ductless glands.

In this connection, it is interesting to note that the first experiment in physiological surgery upon human beings was performed by the gynecologist Robert Battey, of Georgia, who on August 27, 1872, excised the normal ovaries for the relief of a neurotic condition. The physiological basis of this operation, a supposed internal secretion from a specialized set of ovarian cells, has been indicated in many ways. Ovariotomy has been found to have a beneficial effect upon osteomalacia in women. Glass (1899), Morris (1901), Marshall and Jolly (1905) have shown that grafting or transplantation of the ovaries in previously ovariotomized women will reestablish menstruation, sexual desire and general well-being. The experiments of Starling and Lane-Claypole (1906) demonstrated that the inhibitory effect upon pregnancy and lactation of a Battey's operation in rabbits will not be produced by section of the mammary nerves or of the spinal cord. Similarly, the experiments of Brown-Séquard and Poehl on spermin and the fact that ligation of the vas deferens in young animals will abolish the power of reproduction, while permitting full development of the sexual characters and the sexual appetite, go to show that the sexual gonads in the male have an internal secretion, which is supposed to arise from the interstitial cells of Leydig, in the seminal tubules.

(To be concluded)



HOUSTON HALL, the Students' Clubhouse at the University of Pennsylvania, the Headquarters of the American Association for the Advancement of Science.

THE PROGRESS OF SCIENCE

THE PHILADELPHIA MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE American Association for the Advancement of Science and the national scientific societies affiliated with it meet at the University of Pennsylvania, Philadelphia, during the week beginning on December 27. In view of the scientific attractions of Philadelphia and its central situation for those living on the Atlantic seaboard, with convenient access for those living further west, the meeting is sure to be of outstanding importance. This has been the case with the previous Philadelphia meetings. The association was organized there in 1848. After an interval of 36 years the second Philadelphia meeting had a registration of 1,261, the largest up to that time and until very recently. Like the first meeting it marked an epoch in scientific organization in America. Until 1882 there had been only two sections of the association, one for the exact sciences and one for the natural sciences. But the advance and specialization of science led to the division of the association into sections and the establishment of national societies for the different sciences. The American Society of Naturalists was established in 1883 and as special societies were organized in the natural sciences they met with it in the Christmas holidays. National societies in the physical sciences were also formed and held separate meetings. The parent association was thus somewhat weakened, and the summer meetings attracted an attendance of only about 300.

The situation was met by the establishment of convocation week and the affiliation of the national societies for special sciences with the association. The association has aimed to serve as a center of coordination for the special sciences and the special societies, and to keep scientific men in touch with the larger public, leaving the special programs of technical papers to the separate societies The third Philadelphia meeting and at the same time the third of the convocation week meetings held in the Christmas holidays of 1904 had a registration of 890, but the registration of members of the association no longer represents the magnitude of the meetings, as it includes only a part of those attending the sessions of the special societies. When the association was organized in 1848 its membership was 461, at the second Philadelphia meeting it had increased to 2,000, at the third to 4,000 and it is now after ten years over 8,000.

We may thus expect a large meeting at Philadelphia. But while the size of the meeting is the fact easiest to give numerically, it clearly is not the one most important. This is the men and the work they do and report. This year the meeting will be presided over by Dr. Charles W. Eliot, president emeritus of Harvard University, education —a section which was established some eight years ago—being thus for the first time recognized officially in the long list of distinguished men who have filled this office. The address by the retiring president, Dr. Edmund B. Wilson, of Columbia University, on "Some Aspects of Progress in Modern Zoology," in which progress he is the most eminent leader. The evening addresses arranged for citizens of the city are "On the Science of Musical Sounds," by Dr. Dayton C. Miller, of the Case School of Applied Science, and on "The War and the Chemical Industry," by Dr. William H. Nichols, each the one competent in the country on the subject in which he speaks. The general character of the addresses and papers before the sections can perhaps best be represented by giving the ex-

THE INTERIOR OF HOUSTON HALL.

tended list of vice-presidential addresses, which is as follows:

Vice-president Frank Schlesinger, before the Section of Mathematics and Astronomy: "The Object of Astronomical and Mathematical Research."

Vice-president Alfred D. Cole, before the Section of Physics: "Recent Evidence for the Existence of the Nucleus Atom."

Vice-president Carl L. Alsberg, before the Section of Chemistry: "Fermentation."

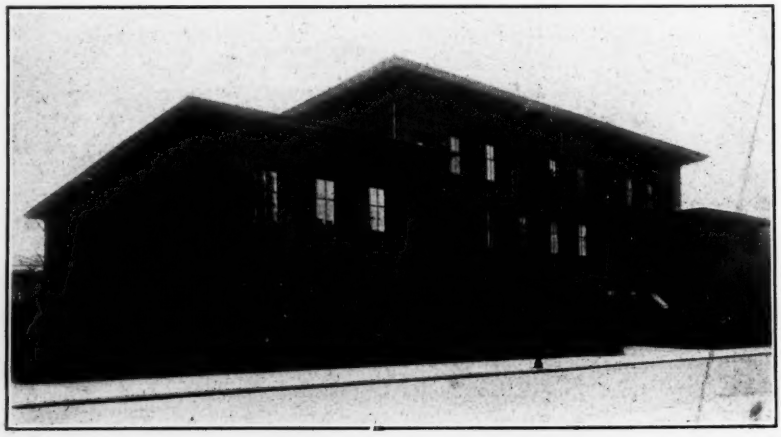
Vice-president O. P. Hood, before the Section of Engineering: "Safety Engineering."

Vice-president Joseph S. Diller, before the Section of Geology and Geography: "The Relief of our Pacific Coast."

Vice-president Alfred G. Mayer, before the Section of Zoology: "The Research Work of the Tortugas Laboratory of the Carnegie Institution of Washington."

Vice-president Henry C. Cowles, before the Section of Botany: "The Economic Trend of Botany."

Vice-president Walter B. Pillsbury, before the Section of Anthropology and Psychology: "The Function and Test



THE HARRISON LABORATORY OF CHEMISTRY.

of Definition and Method in Psychology.''

Vice-president Judson G. Wall, before the Section of Social and Economic Science: ''Social and Economic Value of Industrial Museums.''

Vice-president Theodore Hough, before the Section of Physiology and Experimental Medicine: ''The Classification of Nervous Reactions.''

Vice-president P. P. Claxton, before the Section of Education: ''The American Rural School.''

Vice-president L. H. Bailey, before the Section of Agriculture: ''The Place of Research and Publicity in the forthcoming Country Life Development.''

Perhaps the most notable event of the meeting will be the organization of the new section of agriculture, before which Vice-president L. H. Bailey will give the address noted above, and there will be a symposium on the field of rural economics. But each section will hold meetings of general interest.

As attractive as the programs will be the place of meeting. The buildings of the University of Pennsylvania afford admirable accommodations for all sections of the association and the separate societies, while in themselves affording much of interest to scientific visitors. Houston Hall, which was the first club house for students on a large scale to be established at a university, offers excellent headquarters, where scientific men may meet and where committee meetings may be held. One or two of the societies will meet at the Academy of Natural Sciences, whose fine new building has recently been erected. From the time of Benjamin Franklin, Philadelphia and its institutions have been among the leading educational and scientific centers of the country. It was long our chief city for medical education and research, occupying somewhat the place in science that Boston filled in letters. The recent history of chemistry in America, by Dr. Edgar F. Smith, provost of the university and chairman of the local committee for the approaching meeting, indicates the city's leadership in that science. Other scientific centers have overtaken Philadelphia, and the University of Pennsylvania has suffered from inadequate endowment. But in recent years the growth of the university has been remarkable, and, while it may be difficult for Philadelphia to rival New York and Washington, it will surely make contributions to science commensurate with its wealth and population

THE PROGRESS IN PHOTOGRAPHY

THE history of photography is well illustrated by a series of cameras, plates, and prints exhibited in the U. S. National Museum. This collection of photographic apparatus and photographs, said to be the most complete in the world, has been collected and classified by Mr. T. W. Smillie, photographer of the museum for the past forty-five years. Work of nearly all the early inventors is to be seen, and what is said to be the first American camera, that made on Daguerre's specifications for Dr. S. F. B. Moore, in 1839.

The earliest camera, the camera obscura, used by Euclid in 300 B.C., was later improved upon by Bacon and others in the thirteenth century, and further improved by Porta in the sixteenth century. It is said that the action of light on fused silver chloride was used to make a photograph of the solar-spectrum by Scheele in 1777. Unfortunately there was then no method known for fixing the prints, and in consequence only imitations of this method are to be seen in the museum collection. Thomas Wedgwood experimented along this same line in 1802, and prepared a paper on the subject.

The first successful inquirer to secure permanent pictures through the influence of the sun's rays, seems to have been Nicephore Niepce, who in 1824 effected the process of heliography by th use of a varnish made of asphaltum, or bitumen of Judea, applied to a highly polished metal plate or a glass plate, and developed by essential oil of lavender and white pe-

troleum. The plate was exposed for several hours, the image etched, and then prints were made as from an ordinary etching. The museum collection includes one of the first permanent photographs printed from a light etched plate by the heliographic process. This print is from Niepce's plate made in 1824.

There are also several fine examples of Daguerre's work made in 1839 and later. His process, which came to be known as the Daguerreotype process, consisted of exposing a highly polished silvered copper plate, fumed with iodine, in a camera a few minutes, developing the exposed plate with mercury vapor and fixing the image with hypo-sulphite. This complex process involved five distinct operations; cleaning and polishing the plate, coating the plate with sensitive ioduret of silver, adjusting and exposing the plate in the camera obscura, developing the invisible picture after the exposure, and removing the sensitive coating so that no further change would take place in the picture. Daguerre and Niepce found that they were pursuing experiments of the same nature and went into partnership.

Six months prior to M. Daguerre's publications concerning his process, Mr. Fox Talbot communicated his photographic discoveries to the Royal Society, and afterwards issued an account of his scheme for preparing a sensitive paper for photographic reproduction which he called photogenic drawings. He prepared his paper by washing a sheet of fine writing paper with solutions of salt and silver nitrate. When dried this proved of use in securing prints of leaves, etc., in the camera obscura. Later he used iodide of potassium and other chemicals to perfect his system. Talbot's second process of paper making was patented in 1841, and was known as the calotype. The main advance in this system was the ability of the discoverer to make unlimited prints of his picture. Talbot obtained a third photographic patent on a process for photographing on unglazed porcelain, which a man by the name of Malone improved somewhat and eventually became associated with Mr. Talbot.

The museum collection, besides including many fine and unique examples of these first photographic processes, has much material on modern practical photography, including examples of different printing papers, and plates, stereoscopic pictures, flash-light paraphernalia, X-ray and colored photographs, astrophysical photographs and some early examples of moving picture making.

SCIENTIFIC ITEMS

WE record with regret the death of Charles Sedgwick Minot, James Stillman professor of comparative anatomy in the Harvard Medical School, eminent for his contributions to embryology and biology and for public services in science; of Dr. Theodore Lipps, professor of psychology and philosophy of the University of Munich, and of Dr. Rudolf Emmerich, professor of hygiene and bacteriology in the University of Munich.

THE Hayden gold medal of the Philadelphia Academy of National Sciences has been presented to Dr. Henry Fairfield Osborn, in recognition of his paleontological studies.—The De Morgan medal of the London Mathematical Society has been given to Sir Joseph Larmor in recognition of his researches in mathematical physics—One of the royal gold medals of the Royal Society, has been awarded to Professor Ernest William Brown, of Yale University, in recognition of his investigations in mathematical astronomy

DR. ALLEN J. MCLAUGHLIN, formerly of the Public Health Service, has assumed the duties of health commissioner of Massachusetts.—Dr. C.-E. A. Winslow has resigned from the College of the City of New York to become director of education in the reorganized State Department of Health.